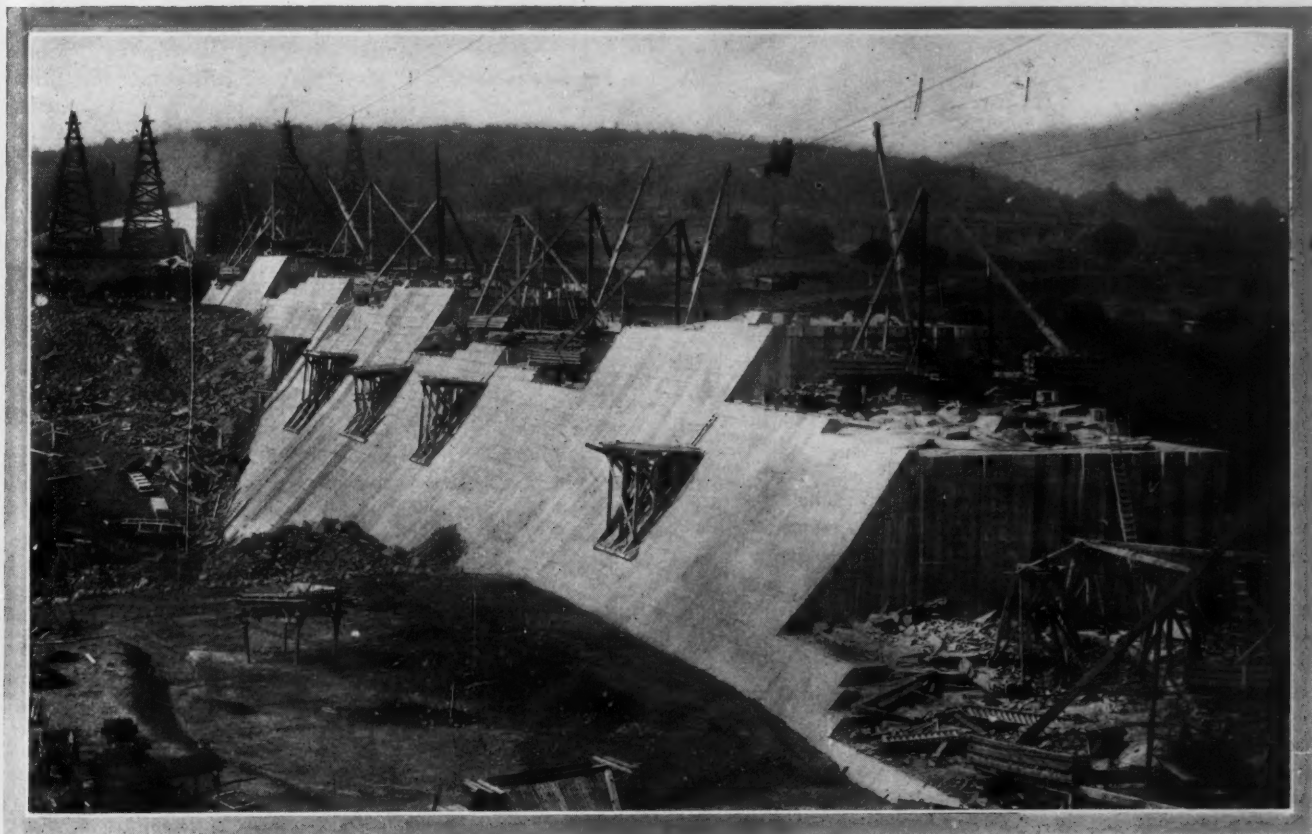


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GENERAL VIEW OF OLIVE BRIDGE DAM UNDER CONSTRUCTION

CATSKILL WATER SUPPLY

Progress Made to Date on Ashokan Reservoir and Aqueduct — Masonry Dam Will Be Completed This Year
—Expansion Joints—Tunneling Under the Hudson—Mud Seams and Caves—Handling Seepage

IN our issue of January 19, 1910, we gave a general description of the new water supply for greater New York which is under construction and has for its aim the bringing to New York City of water from the Catskill watersheds 100 miles away. Work was continued during the year of 1910 even more rapidly than was called for by the contract, and, although to a considerable extent intermitted during the winter, has been under full way for several weeks.

It may be interesting to review concisely the general fea-

tures of this project, and especially of the Olive bridge dam and the Ashokan reservoir. This reservoir is the only one which it is intended to build at present, although the complete plans include the development of three other watersheds.

The reservoir is formed by the impounding of the Esopus Creek by the Olive bridge dam and several dikes. Two branches of the creek meet near the dam, and a dike about 1,100 feet long at this point divides the reservoir into two basins. The west basin has an area of 5 square miles and



PRESSURE AQUEDUCTS UNDER DIVIDING WEIR AND UPPER GATE HOUSE, ASHOKAN RESERVOIR

Built of Concrete in Rock Trench, Instead of by Tunnelling.

available storage capacity of 47,000 million gallons; the east basin has an area of 7.8 square miles and available storage capacity of 80,000 million gallons. The maximum width of the reservoir is 2.6 miles and the average width 1.1 miles. The average depth is 50 feet. The water surface in the west basin has an elevation of 590 feet above mean high tide at Sandy Hook and that of the east basin 587 feet; the dike between the east and west basins serving as a weir over which the water passes from the west to the east. The Olive bridge dam will have a total length of 4,620 feet, 1,000 feet of this being masonry. The top of the masonry dam is at elevation 610, 210 feet above the elevation of the original creek bed and 252 feet above the lowest point in the cut-off trench. The maximum width of the masonry dam at the base is 200 feet and the maximum width of the earth portion of the dam is 780 feet. In addition to the dam there are dikes having a total length of about 3 miles, a maximum height of 110 feet and a maximum width of 640 feet at the base.

Before flooding the reservoir it will be necessary to discontinue and rebuild 13 miles of track of the Ulster and Delaware Railroad. Sixty-eight miles of highways will be discontinued and 38 miles rebuilt. Seven villages will be drowned out, having a winter population of 1,900 and a summer population of about 3,000. It will also be necessary to move 35 cemeteries, most of them private, containing 2,800 bodies.

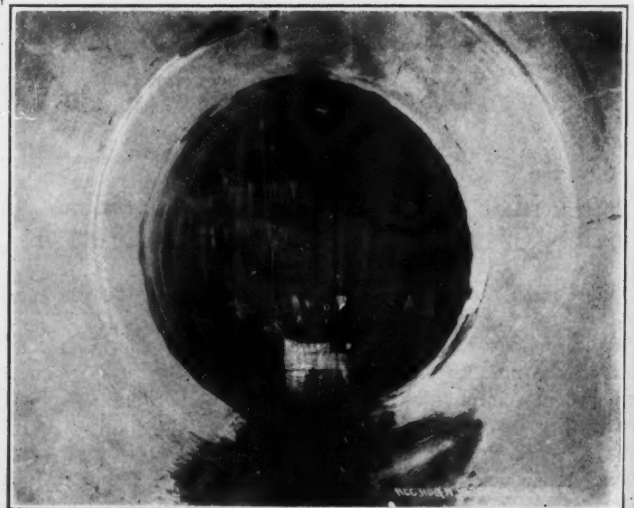
As soon as the dam is completed it will be possible to begin storing water in the reservoir, and to supply it to New York City as soon as the aqueduct is completed. Work on these has been hastened as much as seemed consistent with good construction, and it is confidently expected that the masonry dam will be completed this year, and that water will be delivered to New York City from this supply before the end of 1912. Of the 550,000 cubic yards of masonry in the dam 75 or 80 per cent. has been completed, and practically all of the face blocks have been constructed and are seasoning in the yard. The south end of the dam is practically finished and the general average of the entire dam is probably about 30 feet below its completed elevation.

The dam is constructed of concrete laid in place and con-

taining numerous boulders; molded concrete blocks being used for the upper and lower face, for one face of each expansion joint, and for the blocks around the well holes and galleries. These face blocks are molded in a yard near the work and allowed to season for at least three months before use. These are laid in advance of and kept a little higher than the mass concrete. Up to the present time about 27 per cent. of the mass concrete has been composed of boulders, which are thoroughly imbedded in the concrete and uniformly distributed.

At intervals of 84 feet there are expansion joints extending completely through the dam and from the crest to a little below the surface of the ground, every alternate joint extending entirely to rock. One face of each expansion joint is built of concrete blocks, the surface well covered with crude petroleum and the concrete of the adjoining section placed in bulk against this. In the face built of blocks are left a number of rectangular recesses having an area of about 10 by 20 feet, distributed so as to occupy possibly one-fourth of the area of the joint, with slightly beveled edges, for the purpose of bonding the two sections together. At each expansion joint there is a well hole about 12 feet in from the upper face of the dam, and 6 by 8 feet in section, extending from the level of the water surface to about elevation 440, or 170 feet below the crest and a few feet below the general surface of the ground. At the upper and lower ends of these well holes is a gallery which extends the entire length of the masonry dam, the lower one serving to receive any leakage which may enter the expansion joints and be intercepted by the well holes. The lower gallery has a slight slope from each end toward the center, at which point a branch gallery extends to the lower face of the dam, where there is a manhole giving access to this gallery, and where the seepage water may be observed. In addition to this there are placed 16 feet apart and 12 feet from the upstream face of the dam vertical holes 16 inches in diameter, to intercept any leakage into the concrete, these holes also extending to the lower gallery. Each of these holes is constructed by a pillar of blocks containing openings of the specified diameter, these blocks being made of very dry, lean concrete with the idea that, being porous, they will admit water to the drain holes. Should leakage into the well holes become excessive, it is possible that these will be filled with clay or other substance to cut off such leakage at the expansion joints.

In front of the lower face in the center of the dam is a gate chamber in which are several compartments and the gates connecting them which allow complete control of the flow from each of the basins into the conduit. The excavation for this chamber extends 60 feet into the bed rock, and this excavation has been completed and the foundation concrete has been placed and the gates are now being put into position.



ROUNDOUT SIPHON. LINED TUNNEL SHOWING QUARTER BEND TO UPTAKE SHAFT

The work on the dikes has not progressed as rapidly as that on the dam, chiefly because this was not considered so necessary. The concrete core walls are kept about 20 feet higher than the embankment. Work on the latter is carried on only during favorable weather, when the earth is not too muddy for proper compacting and when it is not subject to freezing. Consequently, little has been done on this work since last fall.

Of the aqueduct possibly the most interesting parts are the tunnels, and of these the one which has attracted the most attention is that under the Hudson River at Storm King. For several years borings were carried on; first, vertical ones at intervals across the river from shore to shore, and later inclined ones from the shore to the center of the river; the object being to locate the tunnel at a depth which would insure the whole of it being in solid rock and having above it a sufficient depth of rock to withstand by the weight of the superposed material alone the upward pressure of the water in the aqueduct. In the center of the channel a fault in the rock was found which extended approximately 1,000 feet below the surface of the river. A vertical drill hole was carried at this point to a depth of 768 feet below mean high tide, when it was thought impractical to extend it any further. Inclined drill holes were then started from each bank of the river and extended toward the center until they crossed each other. Two sets of these were driven, the upper pair crossing at a depth of about 768 feet below mean high tide. At this depth the core showed an unbroken bed of gneiss throughout. It was then decided to locate the tunnel with the soffit of the arch having an elevation of—1,100 on the east side and —1,097 on the west side, thus giving at least 330 feet, and probably 400 feet or more, of solid rock above the tunnel. The tunnel aqueduct will be circular in cross section with an inside diameter of 14 feet and will have a uniform slope, falling three feet from the west toward the east shaft. The latter shaft is carried 42 feet below the tunnel to serve as a sump for de-



TUNNEL LINING COMPLETED, AND WITH SIDE WALLS ONLY COMPLETED

watering the tunnel should it be desired to obtain access to it. The two shafts have been completed to the depths named, this work having been done by the Board of Water Supply by day labor; and the Board has also started the tunnel from each shaft and completed 268 feet of heading from the east shaft and 159 from the west shaft. At this writing it is expected to award the contract within a very few days for completing the tunnel.

This tunnel will be lined with concrete mixed 1: 2: 4, rather wet, and precautions taken to give a smooth surface by greasing the forms and spading the stones back from them.

Other tunnels along the line are nearing completion, these



ROUNDOUT SIPHON. INVERT IN PLACE AND FORMS READY FOR SIDE WALL CONSTRUCTION



SHOWING FLAT WATER-WORN SURFACE OF STRATUM IN ROOF OF TUNNEL; ALSO REGULAR SEAMS IN WALL OF TUNNEL

The Seam Beneath the Roof Bed is a Mud Seam, which Has Displaced the Rock.

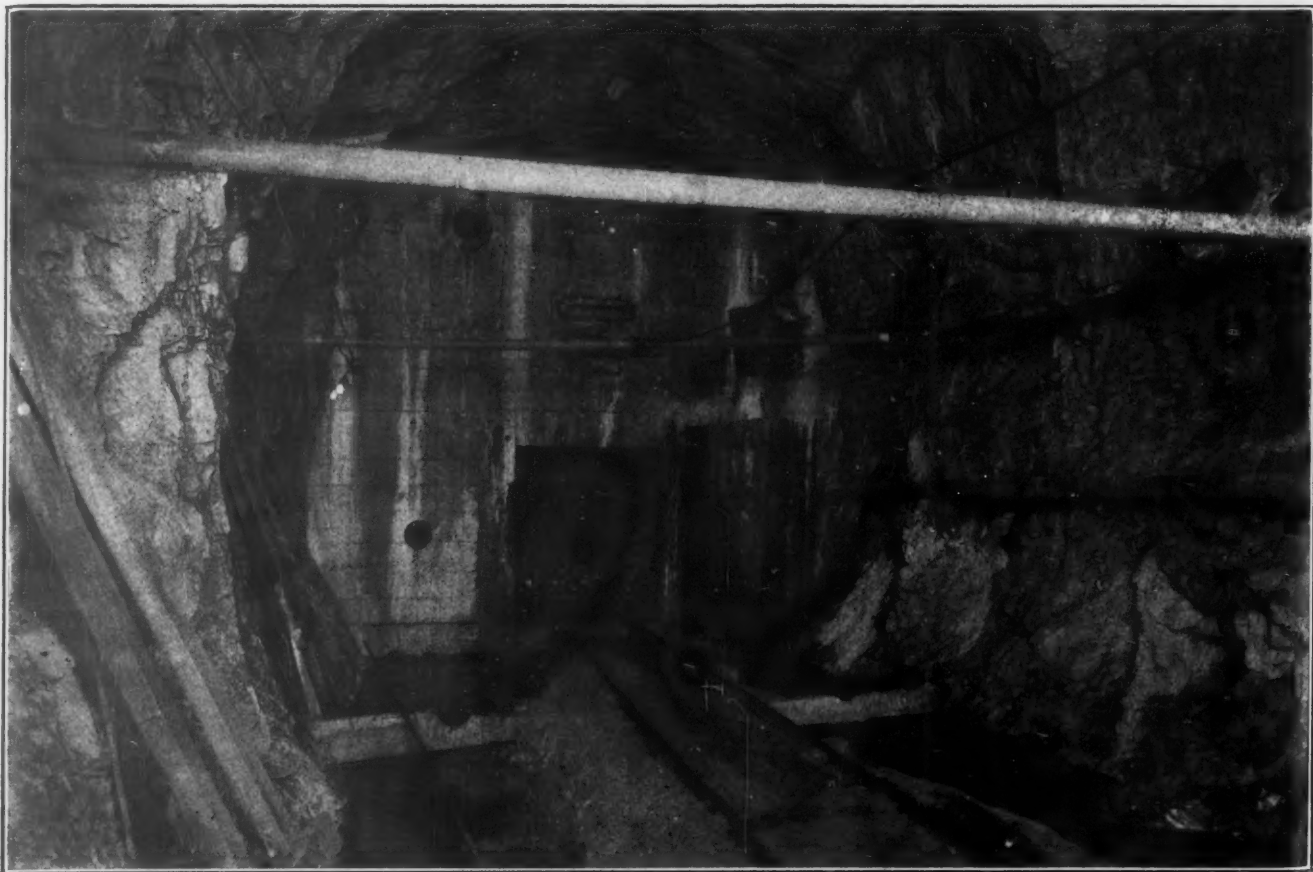
including several which follow the hydraulic gradient, known as "grade tunnels," others serving as inverted siphons, known as "pressure tunnels." A siphon tunnel under Rondout creek is about 24,000 feet long and one under the Walkill valley is about four miles long. The grade tunnels are of horseshoe section 17 feet high and 13 feet 4 inches maximum horizontal diameter. The pressure tunnels are circular, 14 feet 6 inches in diameter. Both these pressure tunnels are in rock, and as in the case of the Hudson River tunnel, are carried to such depth as to insure solid rock throughout their length. The

Roundout tunnel was carried somewhat deeper than this requirement called for in order to avoid as much as possible a stratum of grit which would be extremely difficult to bore through. This brought the tunnel over 400 feet below the surface of the ground.

The tunnels are lined with concrete, Blaw forms being used as centers in most of the work. The lining of the pressure tunnels is placed in three sections, an invert section 5 feet wide being placed first, on which, when it has set, is laid the contractor's track for carrying the forms, the concrete, etc., for completing the lining. Following this the side walls are built, and after this the arch.

One of the interesting features of this tunnel work, which is mostly in limestone, has been the seams and caves encountered. Some of the latter extend for an unknown distance at right angles to the tunnel. When these are encountered the earth found in them is removed to a distance of approximately 20 feet from the tunnel in the case of large caves which extend this far, and this space is filled with concrete. Smaller seams are cleaned out as far as practicable and likewise filled with concrete. One of the illustrations shows a rather wide seam which has been cleaned out for several feet and the remaining earth held in place by steel channel beams placed vertically and held in place by wooden struts. The concrete backing is packed against these steel channels, each wooden strut being removed as the concrete reaches it; this construction being adopted in order to leave no perishable material in the structure.

Wherever there is a seam or hole through which water seeps into the tunnel, a weep-hole is left through the concrete and a corresponding opening in the form, allowing the water to drain into the tunnel while the concrete is being placed. After the completion of the tunnel grout is forced into all these holes under a pressure of 300 pounds to the square inch to render the aqueduct perfectly tight. As it is found that the concrete in the arch section tends to settle away from the



CONCRETE BULKHEAD IN RONDOUT SIPHON. TO PREVENT FLOODING OF PUMPING AND OTHER MACHINERY AT THE BOTTOM OF SHAFT 4

MASONRY DAM CONSTRUCTION

Provision for Slight Settlement and Resulting Stresses—Increase in Unit Pressure and Reduction in Section Warranted —American Engineers Commended

In the presidential address of Edward Sandeman, president of the Association of Water Engineers (England), he took as his theme the construction of impounding reservoirs, and especially the construction of masonry dams. His principal thought was the importance of studying and making allowance for the effect of both compressibility of foundations and masonry and temperature changes upon the masonry, and also the unit compressive strength adopted as a maximum.

He said, in part: I hope that in the future those who are engaged in masonry dam construction will devote especial attention to the recording of the amount of settlement in the foundations, and that, if possible, some information may also be gathered relating to the compression of masonry itself due to its own weight. It has generally been considered (and one authority at least lays it down as an axiom) that for a masonry dam it is absolutely necessary to have an unyielding foundation to build upon. But while such a foundation is no doubt an ideal one, it is to be remembered that all materials are more or less compressible and that settlement must always take place to some extent in the case of the hardest rocks, the amount being, of course, exceedingly small and without doubt difficult of accurate measurement. Masonry dams built upon shale and materials of a similar character must of necessity produce a compression greater than that produced upon the harder rocks, and in these cases measurements of the amount of compression brought about by a given weight could be ascertained without much difficulty and the results recorded. It seems certain that, as the knowledge obtained from such observations accumulates, it will no longer be held that a masonry dam foundation must be an unyielding one.

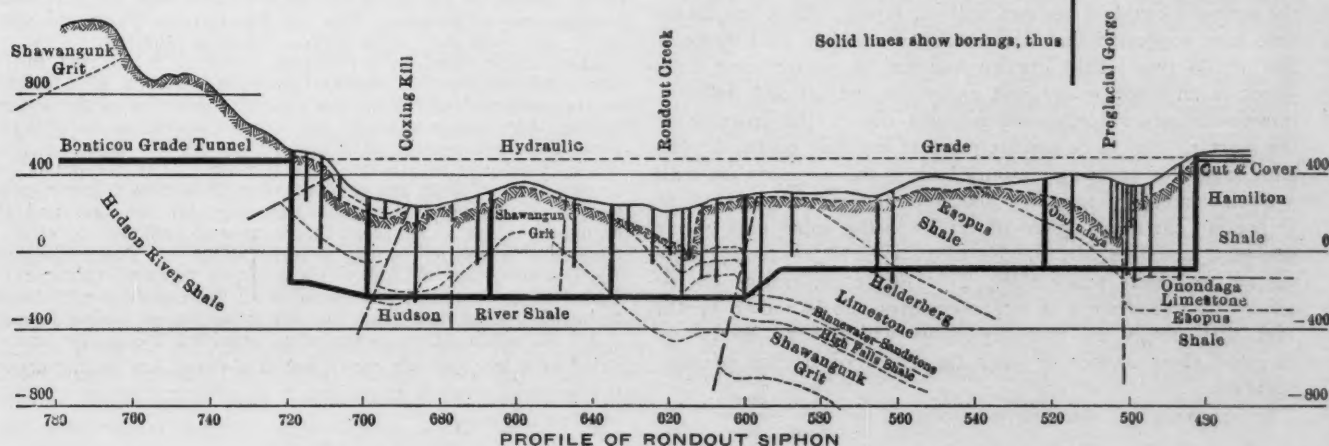
It will not infrequently occur that the various parts of the foundation of a masonry dam, even when this is bedrock, will differ slightly in compressibility, and there must consequently be some adaptation of the masonry to the unequal yielding. Moreover, the compressibility of the masonry itself will probably not be the same as that of the rock, and consequently the settlement in sections of the dam which have different heights, owing to the variation in the depths of foundations, will differ. That masonry will adapt itself to pressure is known, but the extent of its adaptability had not, as far as Mr. Sandeman knew, been ascertained or calculated. Experiments made to determine the movement of high dams when subjected to water pressure have shown slight movements, in all probably bending movements and not due to a real motion of the dam as a whole. It seemed to him probable that when concrete was subjected to a continuous strain for a long period, its continuing to set more firmly through a period of years would enable it to gradually eliminate the strain and the concrete

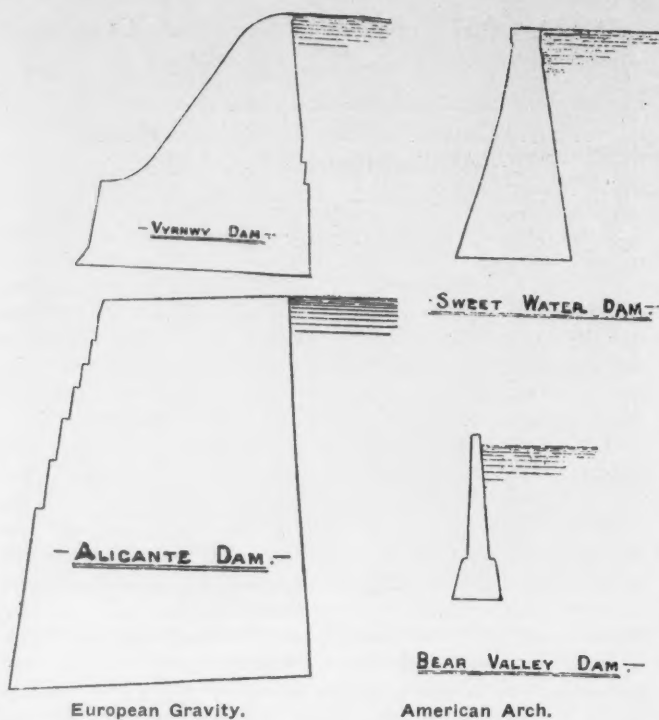


STEEL LAGGING IN MUD SEAM IN SIDE OF TUNNEL

crown after being placed, thus leaving a cavity, similar openings or weep-holes are left at frequent intervals along the crown and dry material placed there while placing the arch concrete; and here also grout is forced in under pressure to completely fill this section of the arch and give it a firm bearing against the rock.

These seams admitted more or less water into the tunnel and the contractors were compelled to keep extensive pumping plants in the tunnels for removing this water to the surface. One of these took the precaution of building a substantial bulkhead of concrete across the tunnel just beyond his pumping plant, this being provided with heavy bronze doors which could be closed practically water tight, in order to prevent the flooding of the pumps should they break down at any time. This bulkhead is shown in one of the illustrations. As a matter of fact this pumping plant did break down and was out of commission for several days; and it is probable that this precaution saved the contractor the expense and delay of pumping out the flooded tunnel with a portable plant located in the shaft, instead of by the comparatively rapid and inexpensive work of the stationary plant which was thus protected.





SOME EXTREMES IN DAM SECTIONS

would take a permanent set in its final position and thus retain its full strength.

Probably of greater magnitude than these movements and stresses due to compressibility is the movement due to variations in temperature. "It was formerly considered that temperature practically remained constant a few feet within a mass of masonry, but even in this country (England) with its moderate temperature, it has been found that 30 feet from the face of a dam there is a change between winter and summer of about 5 deg. Fahr. Close to the surface—say, within one inch—the temperatures vary as much as 70 deg. Fahr. Contraction in masonry produced by low temperature is a much more troublesome thing than expansion and one which in large masses of masonry almost invariably produces cracks of smaller or greater dimensions." Mr. Sandeman referred to observations made on the Boonton, N. J., dam, 2,150 feet long, in which the sum of all the cracks measured was $3\frac{1}{2}$ inches. He stated that if concrete were placed at a temperature of 60 deg., which was raised to 70 deg. by the chemical action, and that this fell during the winter to 40 deg. in the masonry within 10 feet in from the face, this fall of 30 deg. would cause a theoretical contraction of about 2 inches in 1000 feet, which would cause a tension in the masonry of 21 tons per square foot, sufficient to cause cracks in almost any masonry. Cracks thus caused commence at the top of the dam where it is thinnest and extend downward as the cold increases with a kind of tearing action.

The same stress exerted in compression by the expansion of the masonry could be resisted without injury, and it has therefore been suggested that the masonry be laid in cold weather. But to do this would involve building in winter time only, which is an inconvenient and expensive method and liable to introduce more objectionable features due to the freezing of the mortar. Mr. C. S. Gowen, resident engineer on the Croton dam, suggested covering masonry built in the summer time with a thick coating of masonry placed in the early winter so as to prevent the development of cracks in the upper part of the masonry, and this Mr. Sandeman considered a valuable suggestion and quite practicable. That this consideration of the effects of temperature is not a heedless one is shown by the fact that nearly all masonry dams which have been constructed show sooner or later the effect of change of temperature.

In speaking of the limiting stresses in dam masonry he

referred especially to the Croton dam, in which a stress of 14 tons at the base of the downstream face and 15 tons at the base of the upstream face were used in calculating the design. "Credit is due to the American engineers for their boldness in deliberately designing a dam which, while exceeding in height any existing dam by nearly 100 feet, at the same time was calculated to resist stresses so far in advance of anything previously contemplated. French engineers had already constructed dams in which the pressures on the base reached $6\frac{1}{2}$ to 7 tons, and Rankine, in a report dated February 9, 1871, suggesting masonry dams in connection with the water supply of Bombay, had even fixed a limit as high as 20,000 pounds for the upstream base, although he limited the pressure on the downstream base to 15,625 pounds for reasons which he set out, but this great increase in the limiting pressure on the masonry is a striking feature in the design of the Croton dam and one which engineers cannot do otherwise than admire. It is possible the designers were influenced in their decision by the known fact that greater pressures than those fixed by Rankine had already been borne safely by existing masonry. The granite ashlar in the Bear Valley arched dam in California is compressed to the extent of 40 to 50 tons per square foot, and even brickwork has been known to bear as much as 26 tons. Another good reason for increasing the compression limit is to be found in the greater strength now obtained from our cementing materials. So long as the mortar binding the stones of a dam together is weak, the compressive limit must be correspondingly low, for it may be taken that the stone used is stronger than any ordinary mortar; but in these days when cement is obtainable of a uniform character and high strength, there is no longer any reason to confine the compressive stresses to figures below those employed by our friends, the American engineers."

GROSSMAN SYSTEM OF SLUDGE TREATMENT

Past failures have not discouraged those who are laboring on the problem of recovering a part, at least, of the valuable matters in sewage. One of the latest propositions is that of Dr. J. Grossman, a trial of which at Oldham, England, is said to have been very successful. The town has for years been compressing its sludge and filling low land with it, but all available land has now been filled. Dr. Grossman proposes to dispose of it as follows:

By my method the expensive and disagreeable process of filter pressing is altogether eliminated. The settled sludge passes continuously and automatically into a specially constructed drying machine, which delivers it straight into a retort in a dry state, and in which it is mixed automatically with a small quantity of sulphuric acid and subjected to the action of superheated steam. The latter carries away with it all the greasy matter contained in the sludge. This is collected in tanks, and being rich in fatty acids finds a ready sale.

The residue in the distillation retorts is discharged as a fine, dry, brownish powder, free from smell, and contains nitrogen, potash and phosphoric acid mixed up with humus-like earth, which renders it extremely valuable as a manure, being sterilized by the superheated steam. It is free from seeds, germs, or bacilli; it can be stored or used on land without creating a nuisance. The process is continuous and automatic, and thus very little manual labor is required.

The sludge dried in my drying machine is so rich in fat and other combustible matter that mixed with a little coke it can be used as fuel for drying a further quantity of the sludge, and in that case a cake of the same consistency as obtained from the filter presses at a cost of 3s. 6d. for pressing alone can be produced at a cost of 9d. per ton. It is computed that 400,000 tons of soap are used every year in this country, practically all of which finds its way into the sewage, and the recovery of fat alone from that source is sufficient to effect a considerable saving in the present mode of sludge disposal. Besides this, my method yields a cheap manure, valuable for agricultural purposes, and obviates all the nuisance and danger to health arising now from present processes of sludge disposal.

All of which seems practicable, provided the sludge can be dried at a low enough cost. But this detail has so far proved the financial obstacle to success in all similar methods of utilizing sewage solids.

WATER RATES

Scientific Calculation of Rates on Basis of Cost of Service—Service Charge and Quantity Charge—Former Regulated by Size of Service and Meter—Adequate Method of Accounting Essential

THE general superintendent of the Sewerage and Water Board of New Orleans, George G. Earl, in making over and practically re-creating the water distribution service in that city and the management of the department, following upon the completion of the filtration plant to which we have several times referred, has established a system of water rates which he believes to be based upon a logical consideration of the several factors which enter into the problem. The general theory upon which this system of rates was based was described by him in a paper before the American Water Works Association.

Practically nothing was said by him concerning the flat rates, since these rates have been nearly eliminated in that city and almost all of the services are metered. This was brought about by such a relative adjustment of the flat rates and meter rates that the average small consumer pays less than one-half as much for water under meter rates as he was paying under flat rates; and yet the reduction in consumption, or rather in waste, has been so great that the department is abundantly justified in making the lower meter rates. A logical or scientific basis for flat rates would be very difficult to evolve, and some consider that such a thing is impossible, since the very idea of flat rates is illogical and unscientific.

Mr. Earl believes that the only logical and just method of charging for water is to consider each item which enters into the cost of furnishing or supplying the water, and include in the rate a charge for each of these which is not greatly in excess of the cost of the same. The rate would be divided into two general items; first, a "service" charge which will justly differentiate between different characters of service and cover certain costs which are applicable only to the individual served; and second, a charge or charges based upon the quantity of water delivered or of service rendered. In fixing the New Orleans rates he determined as nearly as possible the first cost and essential divisions of the system; the cost of operation, maintenance and depreciation, including interest, with the essential divisions thereof; and third, the essential divisions of the consumption. A proper system of accounting in the department would permit the determination of each of these. Given these figures, he draws a distinct line between those items which should be paid by the taxpayer and those which should be paid as water rates by the consumer, maintaining that public institutions of all kinds, municipal departments and the like, should pay water rates like private consumers, even if such rates are actually paid from the tax fund. It is clearly inequitable, he maintained, for the consumer to pay for water privileges for the schools out of his water rate, since the ratio between his water rate and the sum of all the water rates may be entirely different from that between his school tax and the total of all school taxes.

For metered consumers—and he would place in this class every use of water except through fire hydrants—there would be a service charge depending upon the size and kind of meter and connection, which charge would be the average cost of reading meters of that class, collecting and accounting of water rates, inspection of connections, meters and premises, and interest charges upon, and maintenance and depreciation of, those factors which are essentially and exclusively for the individual consumers—all plus a fair profit if the plant is privately owned. When these variations in the cost of serving different consumers are thus provided for there remains the water itself to be paid for, and Mr. Earl sees no reason why one consumer should be served with this at a lower rate per unit of quantity than another, no matter how great or small his consumption, or whether the consumer be a private individual, corporation or public institution.

A rate built up in this way, based upon known or ascertainable facts and costs, is readily applicable to any conditions and permits of easy adjustment as conditions change. Such rates are easy to understand, court-proof and fool-proof. With such a system as this established the water superintendent or water company has an answer which any citizen can understand to the frequent complaint that "other cities have lower rates," accompanied by a demand that the rates in the city in question be lowered to the same basis. On the other hand it would enable a tax payer or consumer to determine in what respect the department in his own city is being operated less economically than those of other cities.

There are, of course, a number of items to be considered in making up the rates, which are not perfectly apparent at first thought. One of these is the fact that most meters under-register when the quantity of water passing through them is very small; and that this under-registration increases with the diminution of the stream. To meet this point Mr. Earl would establish a minimum rate for the water itself, which rate would be sufficient to allow for such deficiency in registration. These quantities he has fixed for New Orleans as follows: $\frac{3}{8}$ -inch meter serving not over two persons and rooms, 10,000 gallons per year; $\frac{1}{2}$ -inch meter serving not over three persons and rooms, 20,000; $\frac{3}{4}$ -inch meter serving not over four persons and rooms, 30,000; $\frac{1}{2}$ -inch meter, no limitation, 40,000 gallons. For the larger sizes there is no limitation, the quantities upon which minimum charges are based being: $\frac{3}{4}$ -inch, 50,000 gallons; 1-inch, 65,000 gallons; $1\frac{1}{2}$ -inch, 105,000 gallons; 2-inch, 145,000 gallons; 3-inch, 220,000 gallons; 4-inch, 360,000 gallons; 6-inch, 635,000 gallons; 8-inch, 970,000 gallons. For all of the no limitation rates the New Orleans fixed or service charge is 10 cents per 1000 gallons. The service charge is \$4 for the $\frac{3}{8}$ -inch meter, \$5 for $\frac{1}{2}$ -inch, \$6.50 for 1-inch, \$10.25 for $1\frac{1}{2}$ -inch, \$14.50 for 2-inch, \$22 for 3-inch, \$36 for 4-inch, \$63.50 for 6-inch and \$97 for 8-inch. To this service charge is added the quantity charge of 10 cents per 1000 gallons regardless of quantity, except that no quantity charge will be made for less than the minimum quantities named above.

The two divisions of the charge are not given on the bills because this has been found by Mr. Earl to have "an irritating effect upon the mentality of many consumers who are so used to unfair and illogical charges that they assume that any charge whatever, under a new name, is a new form of extortion." Consequently, while the rate has really been calculated scientifically, its final form as presented to the public contains no perplexing intricacies. Another advantage which he claims for this method of rate making is that it provides a way to fairly differentiate between a minimum rate and quantity and charge for a compound or detector meter used on a fire service and a disc, velocity or other non-compound meter used on an ordinary service.

Where one meter is made to serve two or more houses the water rates for which are guaranteed by one responsible owner, the cost per house or per family may be ridiculously small, and there are many cases in New Orleans where it is so. Thus a family occupying a two- or three-room house would have to pay but \$1 or \$2 per year plus their share of the \$4 meter charge, assuming that they did not consume more than 10,000 gallons in the smaller house or 20,000 gallons in the larger during the year. Mr. Earl states, however, that these low payments just as fully reimburse the board for the service rendered as do those made by the largest consumer for the service rendered to him, since the \$4 service charge covers the cost of looking after the service, reading the meter, keeping it in repair, etc., regardless of how much water passes through it.

FIRE HYDRANT RATES

Rational Method of Fixing Hydrant Rates, Based upon Cost of Service—Percentage of Cost of Distribution System Chargeable to Such Service—Cost per Capita—Value of Fire Protection

(Abstract of paper before American Water Works Association, by Leonard Metcalf, Emil Kuichling and W. C. Hawley.)

A BASIS for the determination of a reasonable or legitimate return for public hydrant or fire protection service has, so far as the writers are aware, never been outlined or passed upon judicially by our courts in such a manner as to be of general applicability. The rate established has usually been based upon one of two considerations—either that it should not exceed the average rates paid in the surrounding district or State, or perhaps in the nearest large city; or that the hydrant rental should be substantially equal to the interest charges upon the necessary investment, leaving the water rates to meet the operating, maintenance and depreciation charges and profit. Consequently the existing hydrant rentals are of little value from a theoretical standpoint in assisting to a determination of what constitutes a just and equitable rate.

This paper outlines a rational mode of determining how much income should be derived yearly from the general public fire protection service rendered through public fire hydrants. It does not consider the value of the kindred service rendered by supplying water to special fire-extinguishing apparatus in private buildings, but if the community as a unit bears the cost of the extra capacity required for fire protection, no large additional revenue from special fire protection service can be expected, especially as it requires no capacity additional to that provided for the public protection.

The authors present a table of hydrant rentals in a large percentage of the cities of the country, derived from data compiled by Messrs. Jordan and Grey, of the Indianapolis Water Company. Grouping these according to localities, the table shows that the average rate in 22 cities in the Eastern States in 1909 was \$29.38; the average of 73 cities in the Central and Southwestern States was \$45.03; the average of 24 cities in the Southern States was \$42.54; the average of 6 cities in the Western States was \$28.42; and the approximate average of the total number was \$41.05. The average of all cities except those in the Eastern States was \$43.48, approximately 50 per cent greater than for the Eastern States alone. Inquiries as to whether there had been an increase or decrease in hydrant rentals during the last 20 or 30 years did not secure very satisfactory replies, but these indicated that no substantial reduction had taken place during the past 30 years.

Special reference is made to the statements of the Railroad Commission of Wisconsin (which is practically a general public service commission), which practically expresses its opinion that the revenue derived from public fire protection service is rarely commensurate with the cost of the service. In certain of its reports it makes the following statements:

In the Appleton water works case engineers and experts estimated that the cost of constructing that plant would have been reduced by from 40 to 50 per cent if the plant so constructed had been designed only for domestic use. * * * The separation thus made shows that 54.5 per cent of the plant at Ashland is made necessary to satisfy the demands of the city. It follows that 54.5 per cent of the capacity, or fixed cost of service, should be charged to the city to cover the cost of furnishing water to schools, fountains, other public buildings, for flushing and for fires. * * * Private water consumers have borne a part of the burden which properly should be borne by the taxpayers. The entire community derives the benefit from adequate fire protection, and the cost of this protection should be pro-rated on the entire taxpaying population. * * * It requires no demonstration to show that a large part of the water plant in every town, where the city is a user, is simply held in readiness for the purpose of fire protection. It may not be called into use very often, yet the investment is there and is held in constant readiness. * * * The proportion of the investment necessary for the public service may vary somewhat, depending upon local conditions. It has been held by engineers and water works men, whose experience and study of the question make their opinions of weight, that this

proportion will but seldom, if ever, go below 50 per cent of the total cost of the plant and system.

The Wisconsin Commission decided that in the Madison City case 75 per cent of the total investment was made necessary for fire protection and other public purposes.

The writers believe that the ordinary method of charging so much per hydrant, usually with the additional provision that an additional hydrant should be ordered for every 600 feet, more or less, of extensions in the distribution system, is a less equitable one than would be the payment of a lump sum for public hydrant service, granting to the city the right to attach as many hydrants as it may desire to the water mains of the company, upon the additional payment of the actual cost of such additional hydrants and connections, and making provision for the increase of this annual payment for hydrant service upon some such basis of payment as pro rata increase in population or assessed valuation or pipe line mileage within the municipality or district served by the water works.

Reference is made to the standard recently adopted by a water company which supplies a number of municipalities, which was as follows:

ANNUAL CHARGE FOR FIRE PROTECTION SERVICE.		
Period of contract.	Per mile of distribution pipe system.	Per fire hydrant in service.
1 year	\$325	\$15
10 years	275	6
20 years	260	5

The charge for fire protection service is a combination of mileage charge and annual charge per hydrant, the latter being designed to carry the approximate maintenance and fixed charges of the hydrants.

Obviously the equitable hydrant rental lies somewhere between the cost of the service to the water company and its value to the community. Unless the value is greater than the cost there will be no demand for such service.

The reasonableness of the charge for hydrant rental may be reviewed from five points of view:

1. The cost of furnishing fire protection service.
2. The value of this service to the community, as measured by the saving in fire insurance premiums, ignoring the effect of the economic waste resulting from loss in business, income and wages, in the reconstruction period following the fire, and the loss of property that cannot be replaced.
3. The actual and desirable number of hydrants and distance between them, and the annual rental per hydrant resulting from the assumption of certain gross annual payments for fire protection service.
4. The effect upon taxes, based upon the assessed valuation of property in the municipality or district served, and different assumed annual charges for fire protection service.
5. The relative cost of different kinds of public service—police and public safety, light, and fire protection—in the community served.

COST OF FURNISHING FIRE PROTECTION

The writers do not believe that the general assumption that one-half the cost of water works is on account of fire protection service, regardless of the population and other conditions, is a safe or true one. They believe that the cost of the portion of the water works plant involved by fire protection service probably constitutes from 60 to 80 per cent of the entire cost of the physical property in the case of communities having less than 5,000 population; 20 per cent to 30 per cent in communities of 100,000 population, more or less, and perhaps 10 per cent to 20 per cent in the case of our largest cities.

A diagram is presented showing the opinions of several en-

gineers as to the amount of water required for fire protection service, in terms of the number of fire streams. Freeman presented a curve, the formula for which was worked out by Mr.

Kuichling to be $Y = \frac{x}{5} + 10$, in which y is the number of

fire streams and x is the number of thousands of inhabitants. Mr Kuichling himself several years ago evolved the formula $Y = 2.8 \sqrt{X}$. Assuming each stream to discharge about 250 gallons per minute, the latter formula would give a quantity of $700 \sqrt{X}$ gallons per minute or \sqrt{X} million gallons per day.

The authors assume that the average per capita consumption in gallons per day may be taken to be $32 \sqrt{X}$. This will make the maximum draft from the distributing system for domestic, individual and public uses other than fire hydrants, at the rate of $0.064 X^{3/2}$ million gallons per day when the maximum rate is assumed to be twice the average, and $0.048 X^{3/2}$ when assumed to be $1\frac{1}{2}$ times the average. Therefore the maximum draft for combined fire protection service and other uses is $\sqrt{X} + 0.064 X^{3/2}$ million gallons per day when the maximum domestic rate is twice the average. The ratio between the portion of the distribution-pipe system devoted to fire protection service, and the total carrying capacity of the distribution system is

$$\frac{\sqrt{X}}{\sqrt{X} + 0.064 X^{3/2}}$$

Concerning the assumption that the capacity of the mains for domestic consumption should be twice the average, the authors admit that the actual rate of consumption may considerably exceed twice the average, but consider that this increase could still be taken care of by the mains, the friction, however, being thereby increased and the pressure head lessened. In the case of the larger communities, however, the ratio would probably not exceed or even reach two.

If it be assumed that *without* fire hydrant service a distributing pipe system must be designed for a maximum rate of twice the average domestic and industrial use, whereas *with* allowance for fire hydrant service the maximum rate for domestic and industrial uses may be taken at $1\frac{1}{2}$ times the average rate, the ratio of the difference between the required carrying capacities with and without fire hydrant service to the carrying capacity with such service becomes

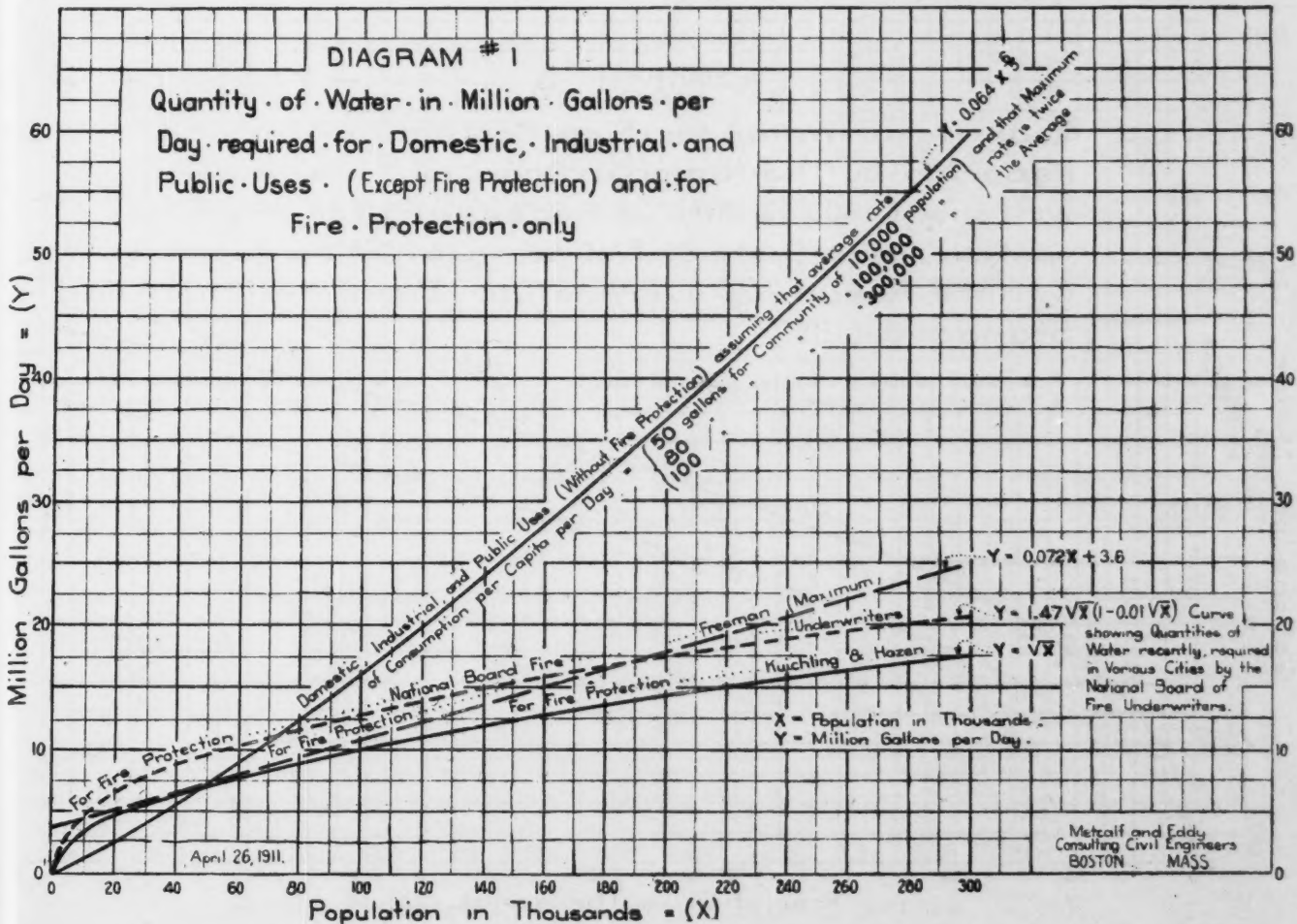
$$\frac{\sqrt{X} + 0.048 X^{3/2} - 0.064 X^{3/2}}{\sqrt{X} + 0.048 X^{3/2}} = \frac{\sqrt{X} - 0.016 X^{3/2}}{\sqrt{X} + 0.048 X^{3/2}}$$

When X becomes 367.74; that is, with a city of 367,740 population, this ratio reduces to zero; meaning that a pipe system sufficient to provide for a maximum rate of draft of twice the average draft for domestic and industrial uses is sufficient for fire protection service coincident with a maximum draft of $1\frac{1}{2}$ times the average.

The authorities have assumed in this paper, as being probably of most general applicability, the conditions above described of twice the average daily rate for domestic service alone and $1\frac{1}{2}$ times this average when combined with fire protection service. On this basis the percentage of the total carrying capacity of the distribution pipe system of a water works plant, which is required for furnishing fire hydrant service, would be as follows for cities of various sizes:

10,000 population	74.1%
25,000 population	58.1%
50,000 population	43.2%
100,000 population	27.1%
150,000 population	17.9%
200,000 population	11.7%
250,000 population	7.2%
300,000 population	3.7%

Under the same assumption, the ratio between the diameter of supply mains required for domestic and fire service as compared with those required for domestic service only would be



QUANTITY OF WATER REQUIRED FOR FIRE PROTECTION, AND FOR ALL OTHER USES

as follows: 10,000 population, 1.718 per cent; 25,000 population, 1.417 per cent; 50,000 population, 1.254 per cent; 100,000 population, 1.135 per cent; 150,000 population, 1.082 per cent; 200,000 population, 1.051 per cent; 250,000 population, 1.030 per cent; 300,000 population, 1.015 per cent. This means that, for instance, in a city of 100,000 population the supply main would require to have a diameter 13.5 per cent larger than if there were no provision for fire protection.

The authors give a table containing the quantity of water in gallons per minute stated by the National Board of Fire Underwriters to be desirable for each of about 125 cities. These quantities do not bear a fixed ratio to the population, since structural conditions and the extent of the high value district and of the conflagration hazard, as well as the fire department strength, have some bearing on these quantities. The authors have, however, attempted to construct a curve approximately representing the requirements of the Board of Fire Underwriters in relation to population, the equation for which is $Y = 1020 \sqrt{X} (1 - 0.01 \sqrt{X})$, in which Y equals gallons per minute and X equals population in thousands. According to this, the portion of the carrying capacity of the pipe system chargeable to fire protection service would be somewhat greater than that already given, these percentages being as follows:

10,000 population	83%
50,000 population	54%
100,000 population	37%
200,000 population	19%
300,000 population	9%

The authors believe that the minimum values in both this table and the previous one are too low, but that the curve probably indicates the general tendencies.

The authors have used their best judgment to determine the approximate percentage of the total cost of water works plants, taken as a whole, which is involved by the requirements of fire protection service, taking into consideration not only the distribution pipe system but also any additional cost involved in

the water supply and reservoir systems, pumping capacity, etc., and the limitations of the assumptions made above as to per capita consumption and fluctuations in rate of water consumption in cities of different sizes. This percentage they represent

by the formula $Y = \frac{147}{X^{0.31}} - 12.1$, in which Y equals per-

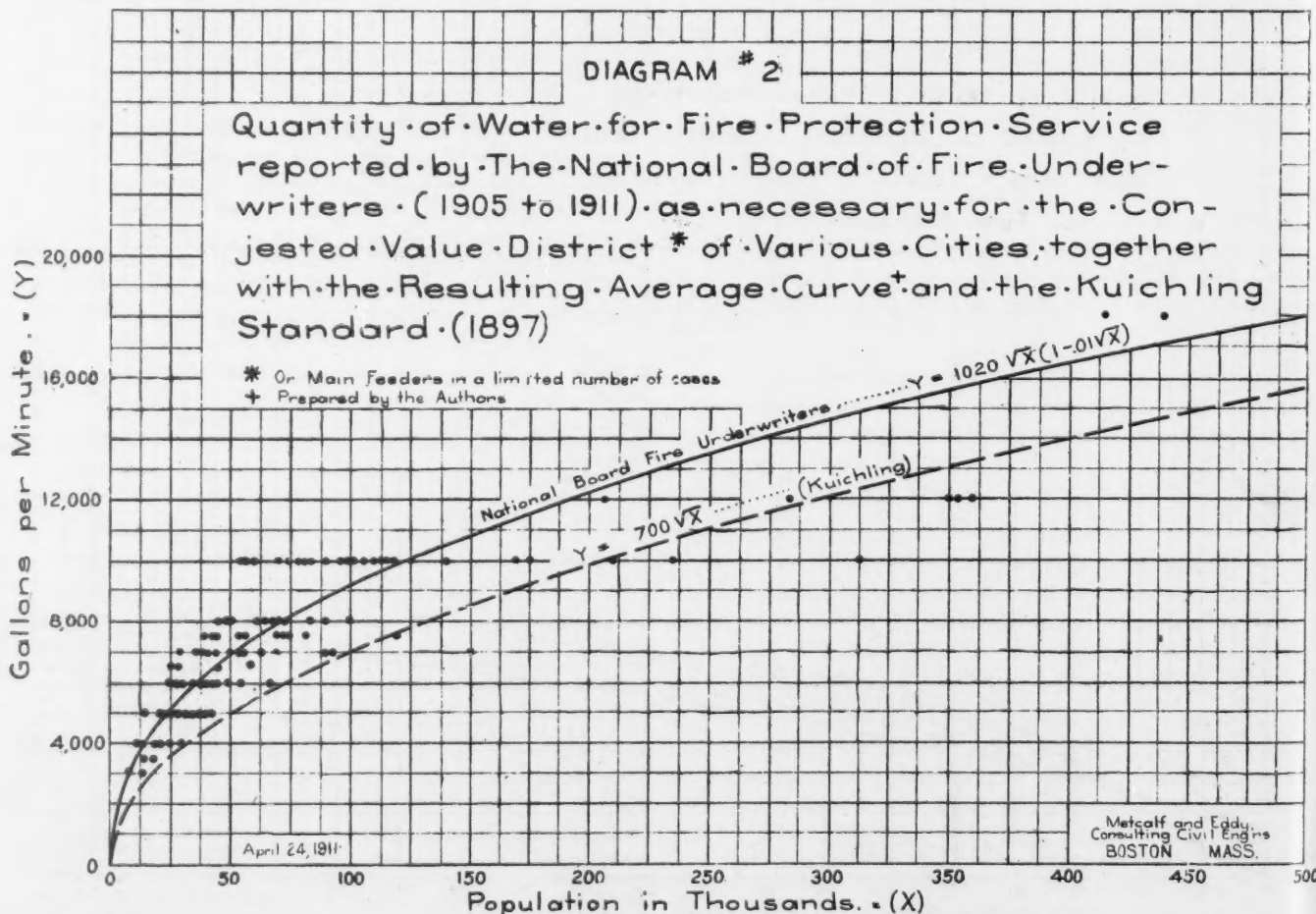
centage of total cost and X equals population in thousands.

In connection with this, as in fact with most of the formulas and figures given, they especially state that these are to be considered of comparative value only, as indicating general tendencies, realizing that substantial departure from the normal conditions assumed is to be anticipated in individual plants; so that if reliable information is desired concerning any particular plant the studies should be based upon the actual conditions existing at that plant. The equations and relations are summed up in the following table.

ESTIMATED COST OF PORTION OF WATER WORKS PLANTS, CHARGEABLE TO FIRE PROTECTION SERVICE.

Population.	Cost of Distrib. Pipe System in Percent. of Total Cost of Water Works.	Percent. of cost of Distrib. Pipe System Chargeable to Fire Protection Service under Nat'l Bd. of Fire Underwriters' Standard.	Percent. of Cost of Entire Plant Chargeable to Fire Protection Service.
5,000	72%	..	77%
10,000	68%	50.3%	60%
50,000	54%	23.8%	32%
100,000	47%	13.1%	23%
300,000	39%	1.6%	13%

The data obtainable relating to operating and maintenance charges involved in fire protection service were meager. It is believed that these charges lie between 5 and 10 per cent of the total annual operation and maintenance charges, including taxes but excluding depreciation, interest and profit allowances. Assuming a gross income for small works of 15 per



QUANTITY OF WATER CONSIDERED NECESSARY FOR FIRE PROTECTION BY NAT'L BOARD OF FIRE UNDERWRITERS

cent of their value, and assuming 10 per cent of this chargeable to hydrant protection service, they obtain an annual cost of operation and maintenance equal to 1.5 per cent of the value of the property; and for large works by similar assumption obtain 0.6 per cent of the value. For depreciation, interest and profit allowance they assume a depreciation of one to 2 per cent; interest, 6 per cent; profit, 0 to 2 per cent, giving a total of 7 to 10 per cent of the value of the portion of the system involved by fire protection service. Applying these figures or assumptions to the general range of per capita values of water works, they obtain the following table:

ESTIMATED APPROXIMATE PER CAPITA COST OF PUBLIC FIRE HYDRANT SERVICE.

Item. (1)	Towns of 5,000 Population. (2)	Cities of 50,000 Population. (3)	Largest Cities. (4)
1. Value per capita of water works..	\$20.00	\$30.00	\$35.00
2. Percentage of portion chargeable to public fire hydrant service....	77%	32%	15%
3. Per capita value chargeable to public fire hydrant service.....	15.40	9.60	5.25
4. Operation and maintenance charges, approximately 10% × 15% = 1.5% of value of entire plant, for towns; 7.5% × 12.5% = 1% for average cities; 6% × 10% = 6% for largest cities	0.30	0.28	0.21
5. Annual charges on public fire hydrant service, covering depreciation and interest, say 8% of Item 3	1.23	0.77	0.42
6. Total annual charges per capita...	\$1.53	\$1.05	\$0.63

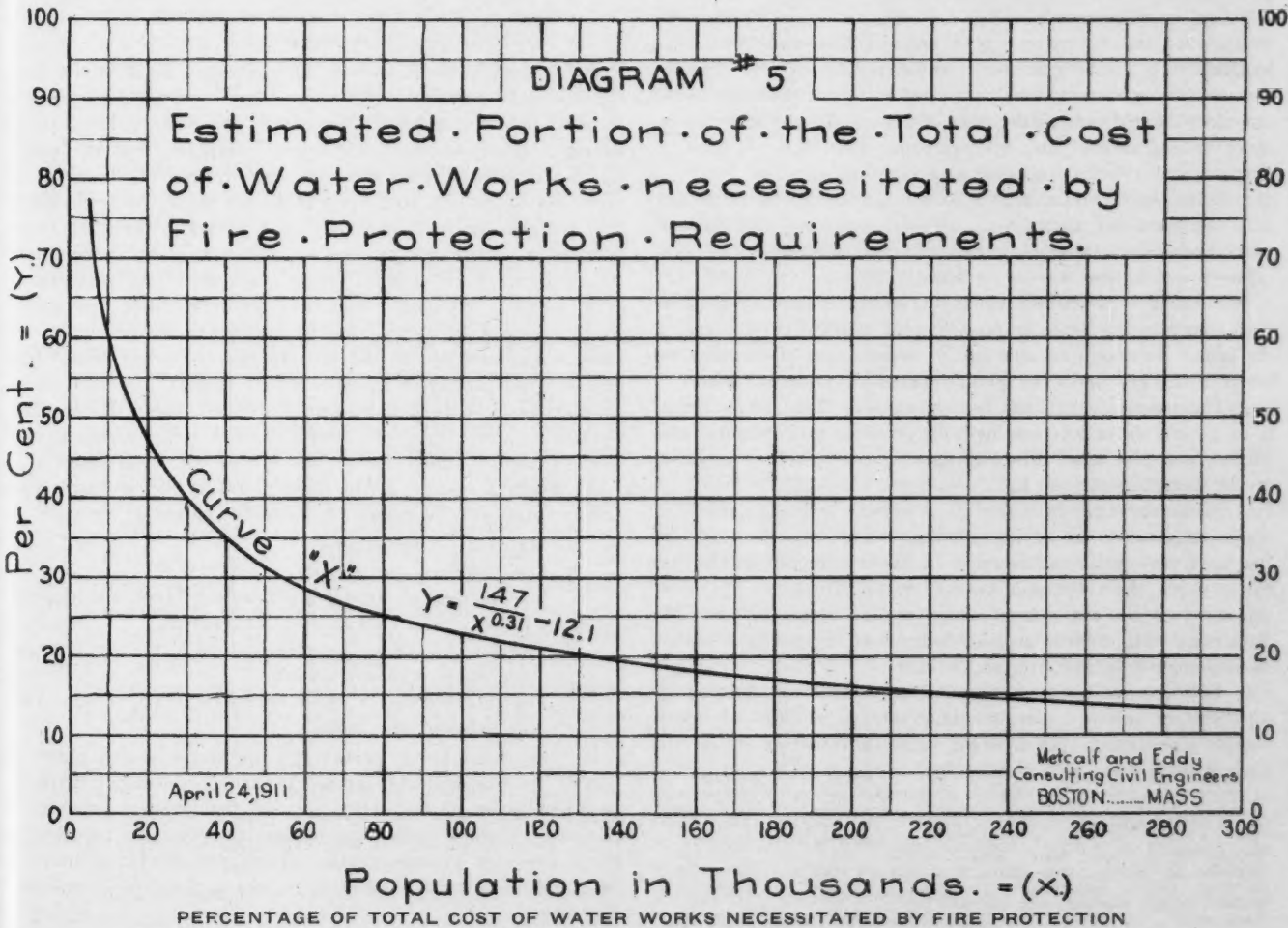
It is perhaps fair to infer, in default of more exact information, that the average cost of public fire hydrant service may be approximately \$1.00 per capita, with variation of about 40 per cent, more or less, though every plant must be examined individually, as the range of variation is obviously a large one. Few works receive an aggregate hydrant rental approaching

this amount, which is but another ground for the authors' contention that hydrant rentals rarely bear any relation to the cost of the service, usually being "traded out" as an offset to franchise and other business considerations.

Taking data contained in the census report for 1907 for population, miles of pipe and number of hydrants, and assuming a per capita cost of fire protection service of from 60 cents for the largest cities to \$1.25 for the smallest, the authors obtain an annual cost per hydrant of \$56 for cities larger than 300,000 population; \$42 for those between 100,000 and 300,000; \$58 for those between 50,000 and 100,000; \$55 for those between 30,000 and 50,000; or a general average for the country of \$55 per hydrant.

VALUE OF FIRE PROTECTION SERVICE

Concerning the value of fire protection service to the property protected and to insurance companies, the authors present a number of tables and figures obtained from fire insurance companies, the National Board of Fire Underwriters, the New York State Superintendent of Insurance and other sources. These figures include fire losses in various cities and States, fire risks, premium receipts, etc. They were advised by insurance men that the introduction of a water works system into a community effects a saving to the insured of at least 25 per cent to 33 per cent of his insurance rate, and a still greater saving to the insurance company. It is also stated that, with the stock fire insurance companies in New England, the prevailing average insurance rates in cities having a good water supply increase from one-fourth to one-third when the distance between hydrants is greater than 500 feet, and may be increased to even two or threefold upon mercantile property. Taking the figures obtained for Massachusetts, the authors find that, with a reduction in insurance rate of 20 per cent there would be a corresponding saving in insurance premiums of \$1.08 per capita of all population; while if the reduction should increase to 50 per cent the saving would correspondingly increase to \$2.70 per capita. Assuming that the actual saving to the insurance com-



panies, and consequently the reduced risk, amounted to 33 per cent, there would be effected a saving of \$1.80 per capita per year by the fire protection service of a water system.

SPACING OF HYDRANTS

The system of charging for fire protection by hydrant rental or by any system based upon the number of hydrants is considered by the writers to be very unfortunate, as they believe the placing of hydrants close together should be encouraged—150 to 250 feet apart in important thickly built up districts, and 300 to 500 feet apart in residential districts. Even if the city is called upon to bear the added expense of making the installation, the saving to it in better service and in reduced length of fire hose required more than offsets the expense involved. Concerning this they quote the chief engineer of the Board of Fire Underwriters, George W. Booth, as follows:

Hydrant Spacing.—The quantity of water required for any district having been fixed upon, proper hydrant distribution may be best determined from a sketch plan of such a number of hose lines as are necessary to care for this quantity; a consideration of friction losses in hose indicates that for anything like effective service no hose line should exceed 600 feet in length if from a fire engine, nor 500 feet if direct from a hydrant, unless the hydrant pressure considerably exceeds that usually found where direct hydrant streams are depended upon. Comparatively few fire departments undertake to place more than one engine, serving an average of two hose lines, at a hydrant, or to use more than two direct hydrant streams from each hydrant. Under those conditions most high value mercantile and manufacturing districts will require at least one hydrant to each 40,000 square feet of area, and ordinary well-built-up residential districts one hydrant to each 100,000 or 120,000 square feet. As good or better distribution will be found in many of our larger cities, and in the case of mercantile districts corresponds roughly to a linear spacing of 150 feet and in residential districts of 300 feet. For each mercantile block 400 by 300 feet, center to center of streets, there should be at least three hydrants, probably located to the best advantage two at each street intersection and one intermediate hydrant on the long side of the block.

A table is given by the authors, showing the spacing of fire hydrants in 62 cities. The average distance between hydrants (number of hydrants divided into feet of mains) ranges from 299 feet in Schenectady, N. Y., to 883 at Lynn, Mass. The average of the 62 cities is 555 feet. The area served by a hydrant they consider a more valuable measure of efficiency than the linear distribution. This ordinarily ranges from about one acre per hydrant in districts of high value, to three acres, more or less, in well built up residential districts.

RECAPITULATION AND CONCLUSIONS

1. Public fire hydrant service in the United States is usually paid for upon the basis of an annual rental for each hydrant.

2. These hydrant rentals rarely bear any relation to the cost or the value of the service rendered.

3. They have heretofore usually been determined by average prices paid in the State or surrounding district, in the case of the larger communities, and by the requirement of meeting the interest charges upon the plant investment in small ones.

4. The range of hydrant rentals paid in the United States is in general from \$100 per hydrant per year to a nominal sum of \$10, more or less. The average hydrant rental is probably in the neighborhood of \$40.

5. Statistics obtained from 76 American cities supplied by water companies out of 140 circulars sent, indicate that there has been no substantial decrease in hydrant rentals in the last thirty years, the substantial reductions occurring in only about one-third of the cities from which replies were received. The data upon this subject are, however, not sufficiently complete to make general characterization safe.

6. The average number of hydrants per mile of distribution pipe system and the corresponding average amount of distribution pipe system per hydrant in 63 different cities in the United States are as follows:

	No. of Hydrants Per Mile of Distribution Pipe.	Average Amount of Distribution Pipe Per Hydrant in Feet.
Average of 63 United States cities.....	9.5	558
Desirable in heart of large cities.....	35 to 21	150 to 250
In closely built-up residential sections.....	26 to 18	200 to 300
In residential districts with houses well separated	18 to 9	300 to 600

The general tendency is to reduce the hydrant interval, and this is desirable. No hard and fast rule can, however, be laid down for the proper hydrant interval, local considerations—value of property, character of fire risks, water supply as to the size of mains and quantity and pressure of water available, danger of interruption of service, cost, etc., must control.

A better basis for the consideration of the adequacy of the hydrant installation is perhaps to be had in a study of the area to be served by each hydrant in different parts of the city, the general range of values, under the best modern standards of service, being from one acre, in the mercantile and manufacturing districts of highest value, to three acres, more or less, per hydrant in the well-built-up residential districts.

From an insurance point of view, however, the individual districts should be studied with reference to the number of fire streams which can be massed upon them effectually.

7. The additional cost of installing extra hydrants upon existing mains probably ranges from \$50 to \$150 per hydrant, the former corresponding to the outlying residential districts with unpaved streets, the latter to conditions existing in the heart of the city where the mains are large. The cost of installing hydrants at the time of building pipe lines is, of course, substantially less.

8. The cost of a modern steam fire engine of the sizes ordinarily used is \$5,000 to \$5,500. The cost per year of maintenance of a fire engine company, including the attending hose company over that of a hose company of corresponding strength, is about \$4,000, including operation, maintenance, depreciation and interest charges. The per capita annual maintenance cost is approximately \$1.50 to \$2, exclusive of the interest charges.

The fire engines have been found, recently, to deliver, under average conditions in tests, approximately 88 per cent of their rated capacity, the range in individual cases being from well over 100 per cent to less than 50 per cent of the rated capacity; but it is probably fair to say that under actual conditions prevailing during a large fire or conflagration, not more than 75 per cent of the above stated working capacity, or two-thirds of the rated capacity, is developed.

9. The danger from serious conflagrations, such as the Boston, Chicago, Baltimore and San Francisco fires; property and business losses resulting from them, the hazard involved in having so many services of different character, such as domestic and industrial uses, elevators, fire sprinklers, flushing devices, water motors, etc., upon the same main from which the fire hydrants draft their supply, and greater danger of interruption in service for changes in, and repairs upon them; the construction of buildings covering great areas and reaching to great heights, requiring very heavy water pressures; and relatively greater cost of maintaining steam fire engines to do the same work, have led to the introduction of independent high-pressure fire protection systems in our largest American cities, having one or more independent sources of water supply readily available at very short notice, in very large quantities and under pressures up to 200 or 300 pounds per square inch.

10. Hydrant rentals, or the demand for public fire protection service, may well be examined from five points of view:

- a. The cost of the service.
- b. The value of the service.
- c. The number of hydrants per mile of pipe and the distance between them and area served.
- d. The rate of taxation corresponding to the amount paid for public hydrant service.
- e. The relative cost of other forms of public service, such as lighting and police.

11. The cost of the portion of the water works plant involved by fire hydrant service probably constitutes from 60 to 80 per cent of the entire cost of the physical property in the case of communities having less than 5,000 population, 20 to 30 per cent in communities of 100,000 population more or less, and 10 to 20 per cent more or less in the case of our largest cities.

The approximate annual cost of fire hydrant service is estimated at \$1 per capita, with variations of 40 per cent more or less in different communities, being perhaps from 60 to 75 cents in our largest cities, \$1 in average cities, \$1.25 to \$1.75 in our small well-served towns and cities.

These per capita costs of fire hydrant service amount to about \$55 per hydrant, based upon present practice as to number of hydrants per thousand of population, ranging from 11 to 23 in cities of from 300,000 population to 30,000 population, and per mile of pipe ranging from 10.6 to 12.1 in cities of the size first stated.

12. Data as to the value of fire protection service are very meagre. It is believed that a reduction in insurance premiums of from 25 to 50 per cent results with the introduction of a good water works system, and that the actual saving is much greater, as based upon the returns made by the Insurance Commissioners in the State of Massachusetts.

The saving probably ranges from \$1.35 to \$3, as follows:

With a Reduction in Insurance Rate of	The Corresponding Saving in Insurance Premiums Per Capita Annually May Be Approximately.
20%	\$1.08
25%	1.35
33%	1.80
50%	2.70

13. The cost of public fire protection service is generally much smaller than that of police and public safety, and public lighting service.

14. The most common method for paying for public fire hydrant service in the United States seems to be by annual rental per hydrant, coupled with the requirement that one additional hydrant shall be ordered in the case of extension of the pipe system, for every 600 feet more or less of such extension.

15. Improvement is suggested along the following lines. Let it be provided that:

- a. At stated intervals, of say ten years or more, the annual cost of hydrant or fire protection service as then rendered, including in such cost operation and maintenance charges incurred by fire hydrant service, and depreciation, interest and profit allowances upon the value of that portion of the water works property necessitated by, or chargeable to it, shall be determined. In the latter, allowance for the so-called intangible values should probably be included in many, if not in all cases. This work should be done by an expert, or board of experts in water works practice, acting in a purely judicial capacity regardless of the method of appointment.
- b. Additional hydrants may be placed upon the existing water mains, subject to the approval of the water company, or other competent authority, provided an annual rental be paid for each such additional hydrant, which rental will cover the agreed estimated maintenance and depreciation costs, and interest charges involved by the estimated average cost (or varying cost upon a sliding scale covering different conditions, such as size of main, character of excavation, street service, etc.) of making such installation.
- c. The basic amount paid for hydrant rental be increased annually, to cover extensions of pipe systems made during the year (upon which extensions hydrants may be placed at an agreed interval of spacing) pro rata in the relation of the extension to the length of the pipe system at the time of the review of the hydrant rental question, or in the ratio of the relative assessed valuation of property as of those dates, or in the ratio of the population as of those dates, if the latter can be accurately determined, which is not usually the case. If additional hydrants be desired in excess of the agreed number per mile of pipe on extensions, they can be installed upon the basis outlined above in (b).

In this manner it should be possible to adjust the

hydrant rental annually, without serious issue, and the community will more nearly bear its share of the burden, divided between the public and private and industrial consumers than under the present method.

16. The offsetting of taxes, or franchise, by free or reduced cost of hydrant service, is believed to be undesirable. If the community sees fit to make a charge against franchise or other intangible property, it should be made quite independently of the hydrant rental, or fire protection service payment. The company and the city are both entitled to know just what burden they have to meet, and to be placed in a position to seek legal redress, in case of injustice or inequitable proceedings. The desirability or undesirability of franchise tax is not touched upon herein; the question is not here at issue.

17. In conclusion, the writers desire to call particular attention to the admirable reports which have been published by the National Board of Fire Underwriters upon the water works and fire departments of the leading cities of the United States, in which are contained not only many significant and valuable facts, but suggestions of importance to the designer of water works systems.

WATER WASTE SURVEY IN MEMPHIS

Census Taken by Service Districts—District Consumption Registered Continuously for a Week by Pitometer
—Sources of Leakage

LATE in the year 1909 the chairman of the Board of Water Commissioners of the Water Department of Memphis, Tenn., recommended that a study be made of the waste and other losses of water which were believed to be taking place, with a view to their prevention; and it was decided to carry on such an investigation with the use of the pitometer. Population statistics were gathered during the winter and actual measurements begun in April, under the direction of the Engineering Department.

The section of the city in which the investigations were conducted and the outline of the different districts is shown on the "Progress Chart." The method employed is what is known as the Deacon System, which has long been used abroad, and in detail is as follows:

When the area to be investigated is defined a complete list of all the connections, metered and unmetered, in the district is obtained from the records kept by the department. The amount of water passing through each meter is obtained from the Meter Department, and from the census taken by this division the number of persons supplied by each connection is obtained. From these data the average per capita metered consumption is computed.

While the record for the district is being compiled all the valves in the district are inspected and those not in good condition reported to the Street Department for repairs.

When this preliminary work is finished the valves along the boundary of the district are closed; a pitometer is installed on the supply main feeding the district and the water consumed by the district is measured for a period of about seven days. From this test the average daily consumption and the consumption during the night, when the use of water is low, are determined.

If the amount of water consumed is abnormal the district is subdivided and the consumption of each subdivision measured. The subdivisions showing abnormal rates are selected and tested as follows:

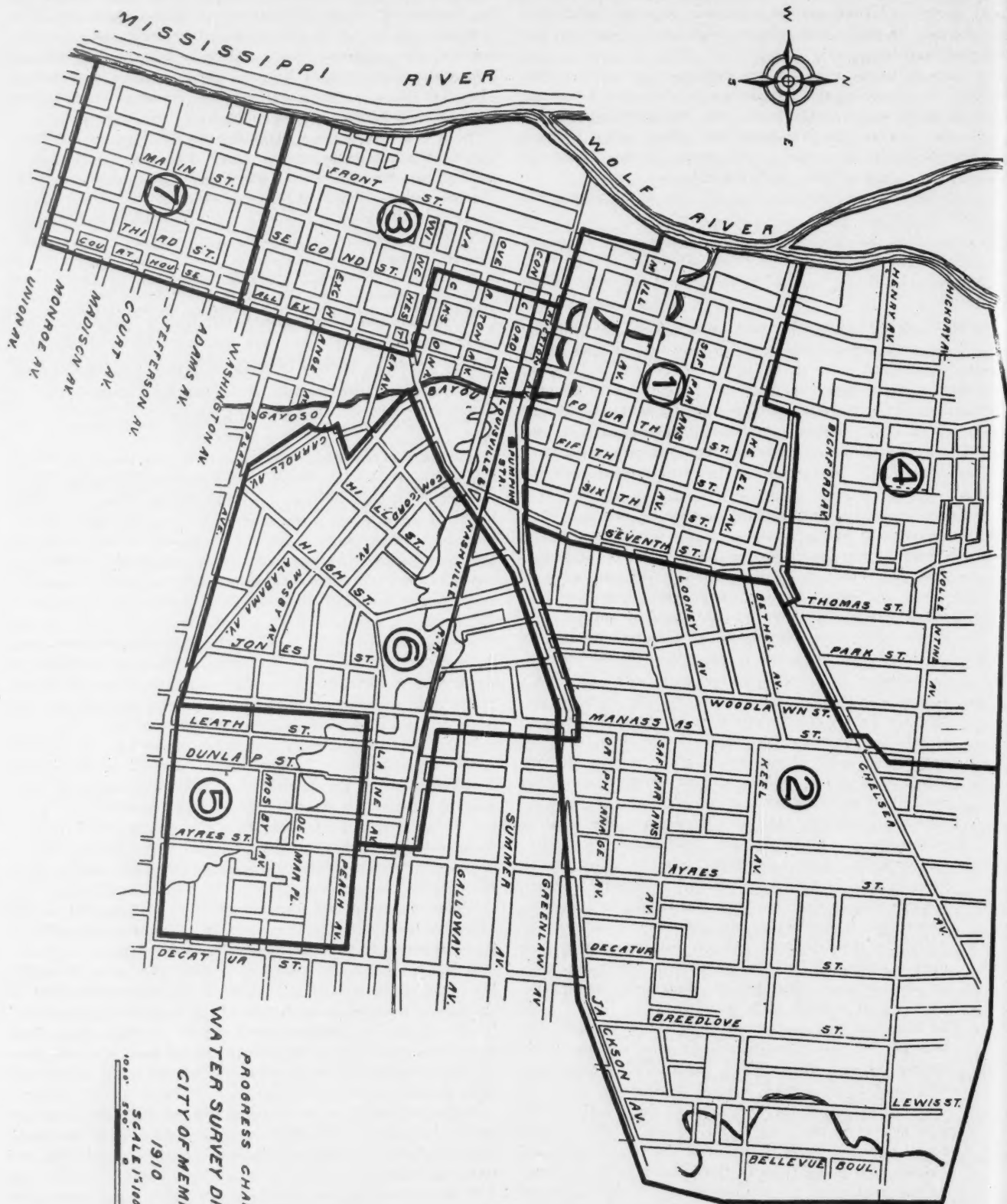
A pitometer is put in operation on a supply main feeding the sub-district, with the boundary valves closed. The area is then narrowed down in successive steps by closing the interior valves and opening the boundary valves. In this manner sections are cut off until the smallest division is reached. As each section is cut off a simultaneous drop in the flow is indicated by the pitometer. The drop or amount of decrease in

the flow is the volume of water used by the portion cut off. By this means the unaccounted-for consumption is located between valves. These tests are made between the hours of 1 and 5 a. m., for at that time the consumption is at a minimum and the rate of flow usually nearly constant.

The sections using the unaccounted-for amount are inspected by testing out each connection with the water phone. This

enables the inspector to detect any leaks, whether in fixtures or in the service pipe below the surface. He is also, very often, able to detect leaks in the main in the vicinity of the connection being inspected.

Where leaks are found within property lines the owners are given notice to make repairs. Other leaks located are reported to the Street Department. After repairs are made the sub-



PROGRESS CHART OF
WATER SURVEY DISTRICTS
CITY OF MEMPHIS
1910
SCALE 1/1600'

PORTION OF MEMPHIS, TENN., COVERED BY PITOMETER SURVEY

district is again tested at night, and if the unaccounted for consumption is still large enough to justify it, the main is uncovered in different places until the source of waste is located.

After each sub-district is tested in this manner and all leaks that can be located are repaired, the consumption of the entire district is again measured for a period of several days to determine the amount of water saved.

The principal sources of leakage found may be briefly described as follows:

Wrought iron supply pipes.

Service pipes.

House fixtures.

Fire hydrants.

Flush tanks.

It was apparent soon after the beginning of the work of inspection that the sewer flush tanks were, in almost every instance, wasting water, some more than others. After the inspection of the first six districts the department decided to have all the tanks in the city inspected at once, and employed men for that purpose, under the direction of the secretary of the department. Up to this time 67 flush tanks have been inspected by the pitometer division, of which nine were found discontinued and the remaining 58 wasting 106,000 gallons per day, an average of 1827 gallons per day per tank. If the remaining 307 operating tanks in the city are wasting water at the same rate, repairing them would make a saving of 561,000 gallons per day.

While the inspection of these tanks was not made by the pitometer division, the necessity for it was shown by previous inspection made by this division.

The mains were found in good condition, all the leaks located in them being joint leaks. In most cases these leaks were caused by the jarring of street cars.

A summary of the work done by the pitometer division during the year is as follows: 1170 acres were covered, in which were 34.9 miles of mains and 4132 connections. The total supply to this section was 2,526,500 gallons per day, of which 818,684 gallons were metered. In this area there were found 116 leaks on private property, 44 leaky supply pipes, 7 leaks in mains, 13 leaking valves, 21 leaking fire hydrants and 35 leaking sewer flush tanks. Stop boxes to the number of 317 were found more or less filled with dirt and were cleaned out. Seventy-four flush tanks were inspected and, as stated, nearly one-half of these were found leaking. The total reduction in consumption effected was 404,000 gallons per day, or 16 per cent of the original consumption.

The amount charged against the pitometer work was \$4251.82, which included cost of tools and the expenses of gathering the census statistics, of which there are enough on hand for the present year's work also. Valuing the water at \$40 per million gallons, the amount saved for the year was nearly \$6000, or approximately \$1700 more than the cost of the work; and a considerable percentage of the saving will extend over a number of years.

THE RED WATER PLAGUE

Effort to Determine Cause of Rust in Water Drawn from Faucets—Effect of Alum Treatment—Galvanic Action—Action on Iron Increased by Heat and Pressure—Remedies Suggested

(Abstract of a paper before the American Water Works Association, by Geo. C. Whipple.)

ACCORDING to the modern and now generally accepted theory the corrosion of iron by water and the formation of iron rust requires, first, the presence of hydrogen ions in the water, and, second, the presence of dissolved oxygen. Hydrogen ions are electrically charged atoms of hydrogen. All acids form them by dissociation. Whenever they are present in solution that solution possesses acid properties. They attack the metallic iron, which is dissolved in a ferrous condition. The oxygen dissolved in the water then oxidizes this ferrous iron and iron rust is formed. Under certain conditions this precipitates at once. Under other conditions it apparently exists in a colloidal state, with its particles electrically charged, and precipitates only when this electrical charge is neutralized. Very little is known about this phenomenon. Certain substances tend to prevent the precipitation of colloids. Thus, peaty organic matter tends to prevent the precipitation of iron.

Iron has a natural tendency to dissolve in water, as the hydrogen ion is always present in some degree. Pure water, therefore, by its dissociation into hydrogen ions and hydroxyl ions tends to act as a weak acid. Iron will be dissolved and rust will form if oxygen is present. Whatever increases the number of hydrogen ions in water increases its corrosive power. Acids do this to a marked degree. Whatever decreases the hydrogen ions reduces the corrosive power. Alkalis do this.

A further conception of the phenomenon of iron rusting is that often referred to as "the electrolytic theory of corrosion." According to this theory a sort of battery action takes place in the water and a current of electricity is set up between the metallic iron at one spot and some other metal or some impurity in the iron at some other neighboring spot. This action demands that the water be to some extent a conductor of electricity—that is, it must contain electrically charged ions—and the higher the conductivity the greater will be the current. The result of this action is that the hydrogen ions give up their charge of electricity to the iron, which goes into solution, while gaseous hydrogen collects on the surface of the metal. As this gaseous hydrogen is a non-conductor, the iron becomes

covered with a film of hydrogen, or is polarized, so that after a time the action tends to cease. Whatever removes the hydrogen from the metal depolarizes it and causes the action to continue. The presence of oxygen in water does this, as it unites with the hydrogen to form water. A circulation of water containing oxygen, whether brought about by mechanical agitation or by thermal currents also tends to remove the hydrogen. Oxygen, therefore, aids the corrosion of iron in two ways, by depolarizing it and by oxidizing the iron that goes into solution.

The presence of other metals also affects the corrosion of iron by increasing the difference of potential, and therefore the strength of the electrical currents. This is termed galvanic action. The metals act differently in regard to the direction of the electrical currents between them and iron. Some cause the positive current to flow toward the iron and some away from it—that is, some hasten the corrosion of iron and some retard it.

The common metals are arranged in the following order of what is called the potential series: Aluminum, manganese, zinc, iron, nickel, tin, lead, hydrogen, copper. Each metal tends to protect the other metals in the series below it from going into solution, but in doing so it itself tends to dissolve. Thus, zinc protects iron. On the other hand, copper acts in an opposite way, and increases the solution of iron. With two metals present, whatever increases the electrical conductivity of the water increases the corrosion of one metal or the other. Substances that when dissolved in water carry a charge of electricity and thus increase its conductivity are termed electrolytes. A typical example of this is sodium chloride. Electrolysis is an important element in various water-works problems, as the members of this association well know.

CLASSIFICATION OF WATERS

The water supplies with which the "red water plague" has been observed may be classified as follows:

Class 1.—Very soft ground waters.

Class 2.—Waters in which the chlorides or the free carbonic acid are high as compared with the alkalinity.

Class 3.—Very soft surface waters which are relatively high in color and contain peaty, organic matter and free carbonic acid.

Class 4.—Relatively soft waters, especially high-colored waters, with which sulphate of alumina is used as a coagulant, but which are not overdosed so far as the alkalinity is concerned.

Class 5.—Waters overdosed with sulphate of alumina so as to render them acid.

Class 6.—Waters containing originally excessive amounts of iron.

Soft Ground Waters.

Some of the ground water supplies on Long Island are troubled with rusty hot water. These waters are invariably soft. In some cases the chlorine is rather high, varying from 10 to 25 parts per million. The dissolved carbonic acid is also high and dissolved oxygen is present. Other waters on Long Island taken from neighboring wells and similar in character, except that the hardness is high, may cause little or no rusty water. In some oxygen is lacking.

The water supply of Far Rockaway is a ground water, aerated and filtered through a sand filter to remove the iron. The process is extremely successful and the filtered water rarely contains more than 0.1 part per million of iron; often none. The chlorine in the water is generally about 7.0 parts per million. The hardness varies from 12 to 15 and the alkalinity from 7 to 12 parts per million. The amount of carbonic acid in the filtered water is presumably low on account of the aeration. A number of instances of rusty hot water have occurred with this supply.

The ground water supply of Garden City, L. I., is somewhat troubled with rusty water. At the Garden City Hotel the marble bowls in the toilet room are at times stained beneath the hot-water faucets, no stains being found, however, under the cold-water faucets. On May 23, 1910, samples of hot water and cold water collected at this hotel were analyzed by Milville C. Whipple, with the following results:

	Parts per Million.	
	Cold water.	Hot water.
Temperature	80° F.	102° F.
Color	0	9.0
Chlorine	11.5	12.0
Hardness	27.0	27.0
Alkalinity	5.5
Carbonic acid	28.0	29.0
Dissolved oxygen	9.34	8.02
Nitrates	2.90	2.80
Iron	0.20	0.30

For purposes of comparison, the following analyses of samples of water collected Oct. 29, 1909, at Flatbush, L. I., also supplied with ground water, are given below. This supply gives no trouble from rusty hot water.

	Parts per Million.	
	Cold water.	Hot water.
Turbidity	0	0
Color	0	10.0
Chlorine	22.5	23.5
Hardness	146.0	146.0
Alkalinity	94.0	94.0
Free carbonic acid	12.0	8.5
Dissolved oxygen	5.6	3.7
Nitrates	5.5	5.5
Iron	0.2	1.1

It will be seen that this water contains more chlorine but somewhat less dissolved oxygen and carbonic acid than the Garden City water. The water is hard. It will be noticed that the amount of iron in the hot water was about five times as large as that in the cold water and was much larger than was found in the hot water at Garden City, yet the Flatbush water does not give any precipitation of iron rust when the water is heated. This may be due to the protective action of the carbonates producing the high alkalinity.

Waters in Which the Chlorides are High but the Carbonates Low.

Many waters of this class exist along the East Atlantic Coast. As an example, the water supply of a village a few miles north of Camden may be referred to. An analysis of this water, made on April 18, 1905, showed that the chlorine was high but that the carbonates were low. The water as taken from the wells contained an insignificant amount of iron, but the water in the houses was at times more or less rusty.

The water supply of Oswego, N. Y., is taken from the Oswego River. It is very hard and very saline, as the river drains the Syracuse salt-deposit region. Although the river water contained comparatively little iron, the tap water was often very rusty, both hot and cold. This rusty condition of the cold water as well as the hot water seems to be somewhat characteristic of this class of supplies and serves to separate them from the soft waters in which the corrosion is found chiefly with the hot water. Water supplies of beach hotels, being located near the seacoast, are not infrequently affected in this way.

Soft Colored Waters.

It is a well-known fact that soft surface waters corrode the metals used for service pipes. This matter has long received attention in connection with the subject of lead poisoning. The soft, peaty water supplies obtained from the English moorlands act on lead pipe, sometimes to a serious extent. In a number of English cities, such as Birmingham, Sheffield and elsewhere, lime is added to the water to prevent injury to the public health from lead poisoning and to avoid the inconveniences attending the corrosion of other metals.

In a recent paper presented to the Institute of Civil Engineers of Ireland, by W. Kays-Parry, an account is given of the corrosive effects of the Vartry supply of Dublin. The author says:

We all know by experience that since the Vartry water was introduced into Dublin it has become necessary to discard both iron boilers and iron pipe for hot-water supply, owing to the destructive action of the water on the iron. A galvanized-iron cylinder in which hot water is stored is very soon perforated, and for this reason copper cylinders are now almost always used.

This action it is claimed by Dr. Adeney is "due to the presence of minute quantities of peaty matter which undergoes slow fermentation with the formation of carbonic acid as well as small quantities of nitric acid."

In 1900 Clark and Forbes, chemists of the Massachusetts State Board of Health, published a report on the corrosion of service pipes in which the effect of dissolved carbonic acid was found to be of controlling importance. The action was found especially severe when the carbonic acid was high and the water soft.

In many New England cities supplied with soft surface water experience has led to a very general use of brass and lead pipe for hot-water service, and iron pipes have been avoided. Occasionally in recent years trouble has been experienced where galvanized-iron or steel pipes have been substituted. This has been the case in Springfield, Mass., where rusty water troubles have occurred to an increasing extent during the last few years.

Conversely, it is also a fact that in localities where the public water supplies are hard galvanized-iron and steel pipes have been satisfactorily used for hot-water supplies instead of brass. This is true of London, where the water supply is hard, whereas in the cities of Middle England, where the water supplies are softer, such pipe is avoided.

Soft Waters Treated with Alum, but Not Overdosed.

It is to the waters of this class especially that the attention of engineers has been drawn during the last few years, not only because of the seriousness of the rusty water troubles that have occurred, but because, as a result of them, there has been growing up a prejudice against the use of alum as a

coagulant. It should be said at the outset that such an inference should not be too hastily drawn, but judgment should be reserved until the matter has been considered broadly in all its aspects.

One of the instances with which the writer is most familiar is that of the red water plague at Watertown, N. Y., which has occurred since the introduction of a mechanical filter in 1905. The supply of this city is taken from the Black River. The water is an especially difficult one to treat, partly because of its high color, partly because it contains organic matter resulting from the pollution of the river by the wastes of pulp mills and partly because of its relatively low and variable alkalinity. On account of the high color and the fluctuations in the amount of organic matter and alkalinity that suddenly occur without warning, it is necessary to apply rather large amounts of sulphate of alumina. The following figures will serve to give an idea of the character of the water treated and the amount of alum that has been used:

AVERAGE COLOR AND ALKALINITY OF THE RAW AND FILTERED WATER AT WATERTOWN, N. Y., AND THE QUANTITY OF ALUM USED

Year.	Color.		Alkalinity.		Quantity of alum used, grains per gallon.
	Raw water.	Filtered water.	Raw water.	Filtered water.	
1905.....	69	10	39	19	2.07
1906.....	62	9	39	22	2.09
1907.....	69	6	28	12	2.53
1908.....	65	7	31	14	2.34
1909.....	67	8	30	12	2.23
1910.....	70	12	28	10	2.36

TYPICAL ANALYSIS OF WATERTOWN WATER

	Parts per Million.	
	Raw water.	Filtered water.
Turbidity	5	0
Color	78	4
Nitrogen as albuminoid ammonia..	0.204	0.126
Nitrogen as free ammonia.....	0.036	0.018
Nitrogen as nitrites	0.004	0.003
Nitrogen as nitrates	0.150	0.120
Oxygen consumed, 5 min.....	13.00	6.40
Total hardness	37.50	39.00
Alkalinity	33.00	15.00
Incrustants	4.50	24.00
Chlorine	0.50	0.50
Iron	1.10	0.30

Not long after the filter was put into service complaints arose throughout the city that many of the copper-lined water-closet tanks were giving out through corrosion. This appeared to be due in part to a slightly increased conductivity of the water resulting from the alum treatment, but also to the fact that the filtered water was much clearer than the raw river water that has been previously used, so that the tanks, instead of being covered with a thick layer of slime, as they had been, were cleaner and there was greater exposure of the metal to the circulating water, a condition favoring corrosion through galvanic action. At the same time it was also found that the hot water in many of the houses was becoming rusty—so much so that in various instances the water was too dirty to be used for bathing. This was not generally true throughout the city, but was noticed more in some places than in others, being especially troublesome in some houses of recent construction.

A study of the matter at this time showed that the water from the filter as it left the plant contained from 0.05 to 0.2 parts per million of iron and that the cold water in the city contained 0.15 to 0.35. Such an increase in the amount of iron in water passing through the city mains is not an unusual one.

Further evidence that the corrosion of the city mains was not serious was obtained by flushing various hydrants throughout the city. The amount of rusty water drawn at such times was found to be not much greater than that normally observed.

When samples of hot water were compared with samples of cold water, however, it was found that in almost every case the hot water was more highly colored and contained more iron than the cold water. Thus, in May, 1908, hot-water samples

were found to have colors between 50 and 300, while, at the same time, the water as it left the filter plant and as it flowed from the cold-water taps had a color of less than 5. In some instances the iron came from the hot-water faucets as flakes of rust that would settle in a tumbler and cause a thick, reddish deposit on the bottom.

The red water plague was particularly severe during the winter of 1907-1908 at a time when the amount of alum used was rather large and when the alkalinity of the filtered water was low. It should be noted here that the application of the alum to the water at the Watertown filter is watched with great care. The plant is in charge of a chemist and samples of raw and filtered water are collected and analyzed four times each day, and have been ever since the plant was started. These analyses show that the filtered water has always been alkaline to methyl orange or erythrosens. At times, when the alkalinity of the raw water has been low, it has been necessary to use soda ash in order to provide alkalinity for the decomposition of the alum.

These same rusty hot-water phenomena have been observed in many other places besides Watertown. The water supply obtained from the Passaic River at Little Falls and supplied to Paterson, Passaic, Montclair and other places has been the cause of more or less trouble of this character. Here also the water is relatively soft and somewhat colored and is filtered through a mechanical filter, using alum as the coagulant. At Burlington, Vt., some complaints have been made of rusty hot water. The supply is taken from Lake Champlain and filtered through a mechanical filter, using alum as the coagulant. At Charleston, S. C., the red-water plague has existed for a number of years and frequently has been serious. The supply is taken from a shallow storage reservoir on Goose Creek and filtered through a mechanical filter. The water is soft and lime is used as well as alum. Here the red-water plague is said to have existed even before the use of alum.

A more recent instance of the red-water plague is that which occurred at Springfield, Mass., in the spring of 1910. This trouble is said to have begun several years before this, when the supply of the city was taken from the Ludlow reservoir. It became somewhat more serious after the new supply from the Little River was put in service. This water passes through a sand filter before being delivered to the city. At times the raw water is rather high colored and, in order to reduce this, alum is used at times in connection with the filter. The water is extremely soft. Alum was applied to the water in small quantities between April 30 and May 18, 1910, and soda ash was applied between May 6 and May 15. Between May 18 and July 15 no coagulants were applied. During this time, even when no chemicals were being used, the rusty water troubles became serious and a detailed study of the matter was made by the Chief Engineer of the Waterworks Department, Mr. Elbert E. Lochridge, and the writer.

It was found that the trouble was worst in certain apartment houses of recent construction, although a slight trouble was general throughout the city. The color of the hot water in apartment houses varied all the way from 50 to 400, whereas the color of the cold water at the same time ranged from 25 to 45. The hot water also contained large amounts of rust sediment which, on analysis, was found to be composed almost entirely of oxide of iron. Iron was also present in solution or as a colloid. This caused red stains of iron rust on white porcelain basins and in many cases made the water practically useless for all domestic purposes. It caused pipes to become choked and in one case is said to have resulted in the bursting of a boiler.

The boilers used were generally made of cast iron, although in the case of one or two large installations steel boilers were found. The tanks were sometimes galvanized iron or steel, sometimes made of steel blackened on the outside and apparently with no protective coat on the inside. Their capacities varied from 100 to 500 gallons. In practically every case where trouble was observed the water passed through one of these unprotected steel tanks.

It was found that the rusty water troubles were associated with the steel tanks and galvanized pipes of poor quality, and an investigation was made to ascertain the character of the inside of some of the galvanized piping used in Springfield. Samples were obtained from various plumbers and dealers, from the stock of pipe in the water-works yard, and from pipes used in other cities. These samples were sawn asunder so as to expose the interior. The results, taken as a whole, showed extremely bad conditions. Scarcely a single specimen of a perfect pipe was obtained. In some cases there were large areas of the interior of the pipe entirely uncoated with zinc, and where the steel was exposed and coated with rust others were spotted with pieces of mill scale embedded in the zinc coating; others were rough from the presence of dross from the spelter bath; sometimes a line was found along the seam where the coating had not adhered to the pipe, possibly on account of the failure of the acid to remove the mill scale during process of galvanizing. In several pipes where the coating was good, so far as the eye could see, microscopical and chemical tests showed the presence of pinholes where rusting might occur. In some instances a poor coating of zinc on the inside was accompanied by a poor appearance of the outside coating, but the sample as a whole showed that it was not always possible to tell the nature of the inside pipe from the appearance of the outside. A number of samples of galvanized-iron pipe obtained from different dealers and plumbers, from the water department stock and elsewhere were carefully examined both on the outside and inside, the specimens being sawn in two for that purpose. The physical appearance of the coating was first recorded, after which the specimens were examined with the microscope and tested for porosity by means of Walker's test and by the use of ferro-cyanide.

Walker's test was made as follows: The raw edges of the iron and bare spots were first coated with asphalt in order to protect them and then the specimens were placed in a solution of boiling caustic potash. If any iron remained exposed and in contact with the zinc, bubbles of hydrogen gas were generated and could be easily seen with the eye. In the case of many specimens this test was not necessary, as the bare, uncoated spots could be easily detected without it, but in other specimens, which to the eye appeared to be thoroughly coated, this test revealed the presence of pinholes. These might become foci of corrosion, and the beginning of tubercle formation. As corrosion proceeded such tiny bare spots would increase in size until finally a large area was exposed. No specimen was examined that did not show at least one or two such pinholes. The character of the coating on the outside did not always indicate the character of the coating on the inside; that is to say, a good exterior did not necessarily mean a good interior. A bad exterior, however, was invariably accompanied by a bad interior.

Water Overdosed with Alum.

It sometimes happens with mechanical filter plants that more alum is used than can be decomposed by the alkalinity naturally present in the water. When this occurs the filtered water becomes acid and its corrosive powers are greatly increased. Such waters are liable to be the cause of the rusting of iron and steel pipes, tanks, etc., with both cold and hot water. Instances of this kind have not infrequently come to the attention of the writer. One of these was at Athol, Mass., where the supply was taken from a small reservoir and was treated with alum and filtered through a pressure filter before passing to the city. On account of irregular application of the chemical the filtered water was intermittently acid.

Other and very common instances of this overdosing have occurred in New York City and elsewhere, in connection with the use of small house filters where alum is used as a coagulant. These filters are widely used by hotels and apartment houses of the better class. They are commonly provided with a device for applying alum to the water before filtration. Usually the alum control is very imperfect at best and very poorly looked after, and the result is that the water is not infrequently overcharged with alum.

In order to correct any misapprehension in regard to mechanical filtration, it should be stated that mechanical filters with alum used as a coagulant have been in service for many years in many cities of this country, without being the cause of any red-water plague. But where this is the case the waters are relatively hard and the filtered water has a considerable residual alkalinity. The writer has corresponded with many engineers and chemists in various cities where mechanical filters have been used, and the dividing line between those which have caused trouble and those which have not appeared to be sharply drawn according to the hardness of the water; that is to say, the use of alum with hard water causes no trouble, whereas the use of alum with soft waters may cause serious trouble.

Water Naturally Charged With Iron.

Many public water supplies contain excessive amounts of iron and with these rusty water is common, both cold and hot. At Far Rockaway, N. Y.; Red Bank, N. J.; Superior, Wis.; Reading, Mass., and elsewhere filter plants have been constructed for removing iron. Methods of deferrization have been well described by Weston (Trans. A. S. C. E., Vol. 64, September, 1909).

SEASONAL OCCURRENCE

It is difficult to state any particular time of the year when the red water troubles are at their maximum, but, generally speaking, so far as the observation of the writer has gone, the fall and winter months are the worst. This appears to be due in part to the fact that during the winter the hot water is maintained at a higher temperature and for more hours in the day than during the summer, when it is not uncommon to allow the range fire to go out at night. In winter also surface waters contain more dissolved oxygen. Another, and perhaps a more important cause, is the fact that organic matter freshly dissolved in water appears to be more corrosive than organic matter that has passed through various stages of fermentation. The seasonal distribution of coloring matter in water differs in different localities. An increase in color usually occurs during the late fall and early winter, after the leaves have fallen. The maximum color, however, is more commonly observed during the months of May and June, after the spring rains have caused the swamp lands to discharge their waters. In some instances it is said that the hot water is more rusty at the time of this maximum color of the early summer. In other cases, the winter maximum of color, caused by freshly dissolved organic matter, gives rise to the worst conditions.

LOCALIZATION OF RED-WATER TROUBLES

Wherever the red-water plague has been observed a most conspicuous phenomenon has been that the rusty hot water has not been general throughout the city, but has differed greatly in different houses. Often many houses are practically exempt, while neighboring houses may be seriously affected. This was conspicuously true in one instance in Springfield, Mass., where there were two apartment houses on the same street taking water from the same mains under identically the same conditions and with the plumbing arranged in substantially the same way. In one of these apartment houses no trouble was experienced, while in the other the conditions were very bad. The only noticeable difference between these two buildings appeared to be in the character of the material used for the construction of the heaters, tanks and piping used for the hot water services.

If one were to generalize, it may be said that it has usually been found that houses recently built have suffered more severely than older houses; that houses in which brass pipe and copper boilers have been used have suffered little or none at all; that houses in which galvanized wrought iron or steel pipe have been used have been the ones affected and those in which the piping has been apparently of poor quality have suffered the worst. The troubles have been somewhat more marked in buildings where the circulating pressure system is used than in those where the tank system is used, but exceptions have been found, as, for instance, in tall buildings. In short, the

physical conditions that appear to favor the formation of iron rust in hot water are higher pressure, higher temperatures and greater circulation.

In any particular house, differences are noticed in different parts. The water supplied to the lower floors of high buildings is often slightly more discolored than the water supplied to the upper floors, but this difference is not always noticed. When pipes are examined the greatest amount of rust is found where the circulation of the water is most rapid. More is found in horizontal than in vertical pipes. Sometimes the pipes between the heater and the storage tank are very nearly, if not completely, choked with rust. Here the circulation is naturally very rapid.

TEMPORARY RUSTINESS

It is a matter of common occurrence to find the first water drawn from a hot-water faucet to be somewhat rusty, the water afterwards running clear. This may happen even in places where there is no general red-water problem. It is especially likely to happen when the water contains such electrolytes as sodium chloride. It is due to galvanic action between different metals. Thus, where brass faucets have been attached to steel pipes the writer has found the first tumblerful of water drawn to be rusty and the water afterward drawn to be clear. This temporary rustiness is often a conspicuous phenomenon where gas heaters are employed and is apparently due to the use of different metals in places where the temperature of the water is high.

SULPHATE OF ALUMINA

Carbonic acid dissolved in water increases the hydrogen ions present and therefore its corrosive properties. This acid is present in nearly all water, being high in swampy waters and many well waters. It is not driven off by heat when the water is under the pressure existing in city mains. When present in combination with the carbonates of alkaline earths it does not appear to be as corrosive as in soft waters. The effect of organic acids in the corrosion of iron is little understood, although it is generally considered that swampy waters owe their corrosive properties in part to such acids.

When sulphate of alumina is added to water that contains calcium carbonate there are formed aluminum hydrate, calcium sulphate and carbonic acid gas. The increase in the amount of free carbonic acid amounts to 6.8 parts per million for each grain per gallon of alum, assuming the original alkalinity to be in the form of bi-carbonate. Practically the reduction in alkalinity is somewhat less than the theoretical. Fuller believed this to be due to the absorption of a certain amount of sulphate of alumina by clay carried in suspension. The writer has found it to be the case with colored waters and especially with soft colored waters, and it has been found to occur with waters that have been filtered and he suggests that probably some of the alum unites chemically with the organic matter.

It is possible that where the amount of alkalinity in the raw water is very low, the alum reaction does not go to completion, but a certain small amount of aluminum sulphate remains in the water. Conductivity experiments made by Melville C. Whipple have shown that whereas the conductivity of hard water is carried by a very small amount when alum is added, the conductivity of a relatively soft water is sufficiently increased by the addition of the same amount of alum.

Under ideal conditions all of the alum added to the water before filtration is decomposed and takes the form of aluminum hydrate, which is removed by the filter, although if this is not working properly some of the hydrate may appear in the effluent. If the alum reaction should not be complete, but if a small amount of basic sulphate should be formed, it is possible that this might remain as such dissolved in the filtered water. If there is a chemical combination between the aluminum sulphate and the organic matter, it is possible that this compound might pass through the filter either in the form of a colorless solution or as a colloid. In the case of an over-

dosed water, aluminum sulphate itself is present in the filtered water.

If the filtered water should contain basic aluminum sulphate it is reasonable to believe that heating it would tend to complete the reaction so that aluminum hydrate would be precipitated in the hot water. If the filtered water contained aluminum sulphate in combination with organic matter, heating might decompose it and this also would tend to throw down the aluminum hydrate in the hot water. In this connection it is worthy of note that in Watertown analyses of the deposits in the hot-water pipes have shown considerable quantities of aluminum, sometimes as high as 7 per cent.

These changes in the basic sulphates and combinations of alum with organic matter would naturally tend to increase the hydrogen ions and therefore the corrosive properties of the water.

Experiments have shown that when alum is so added to waters the alkalinity of the filtered water is reduced to 5 or 8 parts per million, the filtered water, after long boiling, has an acid reaction when tested with the phenolphthalein indicator, whereas the reduction is alkaline if the residual alkalinity of filtered water as shown by the ordinary methyl orange or erythrosene test is kept higher than 5 or 8 parts per million. Many experiments along this line have been made by the writer and the results are shown in Fig. 1.

From a smooth curve drawn through these results it would appear that when the alkalinity of the filtered water falls below six parts per million the water will commonly have an acid reaction with phenolphthalein after boiling. This acidity of the hot water is apparently not due to carbonic acid.

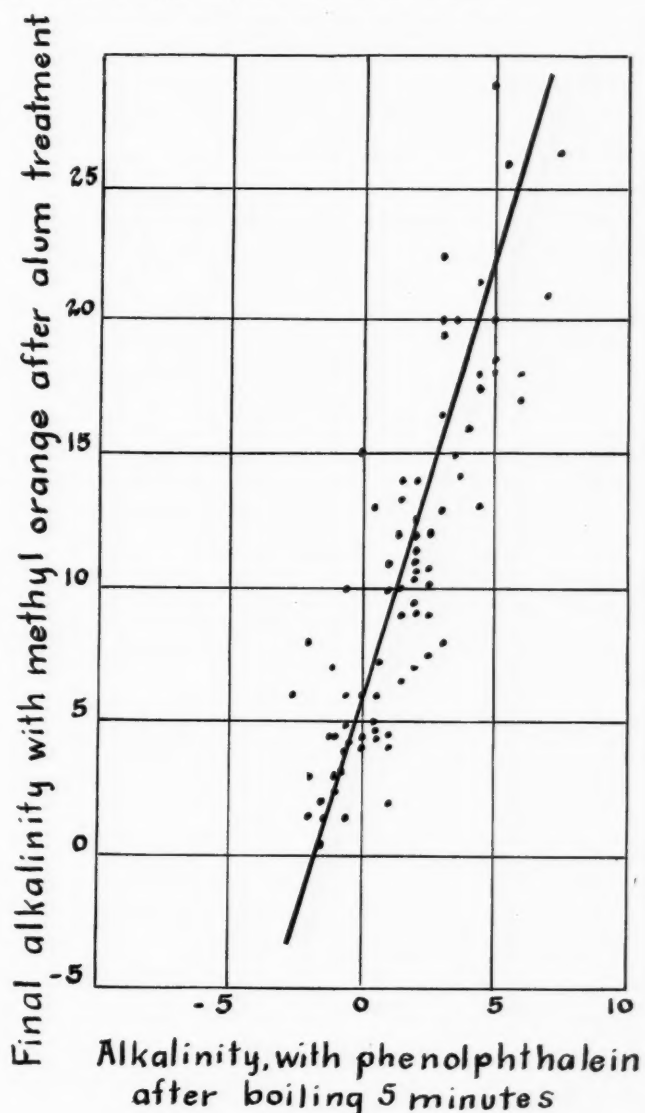


FIG. 1.—TESTS OF ALUM-TREATED WATERS

In a series of experiments made to determine the relative corrosive effects of alum-treated waters in which the residual alkalinity varied, it was found that when the residual alkalinity fell much below 10 parts per million the corrosive effect of the water on iron increased materially.

When waters that contain calcium carbonate are boiled a dissociation takes place, with the formation of the hydroxyl ion. These tend to neutralize the hydrogen ions and thus prevent corrosion.

Whatever may be the explanation, and the chemistry of the subject is by no means clear, the fact appears to be well established that as a result of the application of sulphate of alumina to soft, colored waters a corrosive property is imparted that acts when the water is heated, but that is insignificant as long as the water remains cold.

The theory of corrosion and rusting requires not only the presence of the hydrogen ion, but the presence of oxygen. It has been well proved that where the hydrogen ion is present the rusting of iron is proportionate to the concentration of the oxygen. The greater the amount of oxygen, therefore, the greater the rusting. Generally speaking, hot water contains more than enough oxygen to oxidize the iron dissolved and it is probable that the increased corrosion attending increased amounts of dissolved oxygen is due to its action as a depolarizer.

Surface waters used for public supplies usually contain oxygen up to their saturation point. The solubility of oxygen decreases as the temperature rises. Near the freezing point water will hold in solution about twice as much oxygen as at

summer temperatures. The solubility decreases according to a regular curve and at the boiling point becomes nil.

The solubility of oxygen is also affected by pressure and increases directly with it. Water under a pressure of two atmospheres will hold twice as much oxygen as water under a pressure of one atmosphere. The solubility of oxygen in water at different temperatures and pressures is shown in Fig. 2. When water saturated with oxygen is heated, the pressure remaining the same, oxygen gas is liberated. This is also true of the dissolved nitrogen. Experiments made in this country and also in Germany have shown that heating water increases electrolytic action between dissimilar metals in contact with such water.

Some ground waters contain little dissolved oxygen and these waters do not seriously rust pipes.

Experience has shown that the more rapid the circulation of water through a hot-water system, the greater is the rusting of the pipes, since it prevents the accumulation of hydrogen on the iron surface, that is, prevents polarization. Corrosion is also increased by the exposing of fresh surfaces due to the mechanical removal of the rust already formed. The increasing tendency to use the circulating system of hot-water distribution in houses may in part explain why the rust problem is more serious now than formerly. The circulating pipes between the heaters and boilers often become completely choked with rust when the rest of the system is much less affected.

It has been found in several cities that water in which lime has been used either for softening or in connection with copperas contains normal carbonates, and acts on the zinc coatings of pipes, dissolving the zinc and exposing the iron to the water. Such water will even remove zinc from alloys, and meters and other fixtures have suffered in consequence. These waters do not corrode iron, but if, after pipes have had their zinc removed the water should change in character and no longer contain an excess of hydroxyl ions, corrosion would probably become serious.

Iron fully protected with zinc would apparently not be subject to corrosion and the red-water evil. In Springfield it was apparent that the worst red-water conditions existed in the buildings of cheaper construction where unprotected steel tanks were used. Examination of some of the pipes which were completely choked with iron rust showed them to be made of steel very badly galvanized. Experiments on the relative corrosion of wrought iron and steel pipes have been inconclusive, but so far as practical experience goes it appears that the best results are obtained by using the best grades of wrought iron. However, the better grades of steel pipe are probably more satisfactory than the poorer grades of wrought iron. But probably the most important thing is the thoroughness of galvanizing.

For the best protection pure zinc should be used, and not an alloy. It should be of sufficient thickness and applied so as to thoroughly cover the pipe at all points. If the mill scale is not properly cleaned from the pipe; if the acid used in pickling is not thoroughly washed off; if the temperatures of pipe and zinc are not right; if the zinc bath is used too long, so that dross accumulates in the dipping tank; and if other precautions are not taken the galvanized coating will not be satisfactory. In the course of inspection of many pipes taken from buildings and found in the shops of plumbers it has been often noticed that the galvanized coating is very imperfect. Unfortunately minute openings in the zinc coating are apt to be present even when the galvanizing is carried on in the best possible manner.

REMEDIES

If the above-mentioned theories of corrosion are correct, the logical methods to be used for preventing rusty hot water would be along the lines of reducing the hydrogen ions in the water or increasing the hydroxyl ions, getting rid of the dissolved oxygen, reducing the pressure, temperature and circulation, and using pipes of good quality selected with refer-

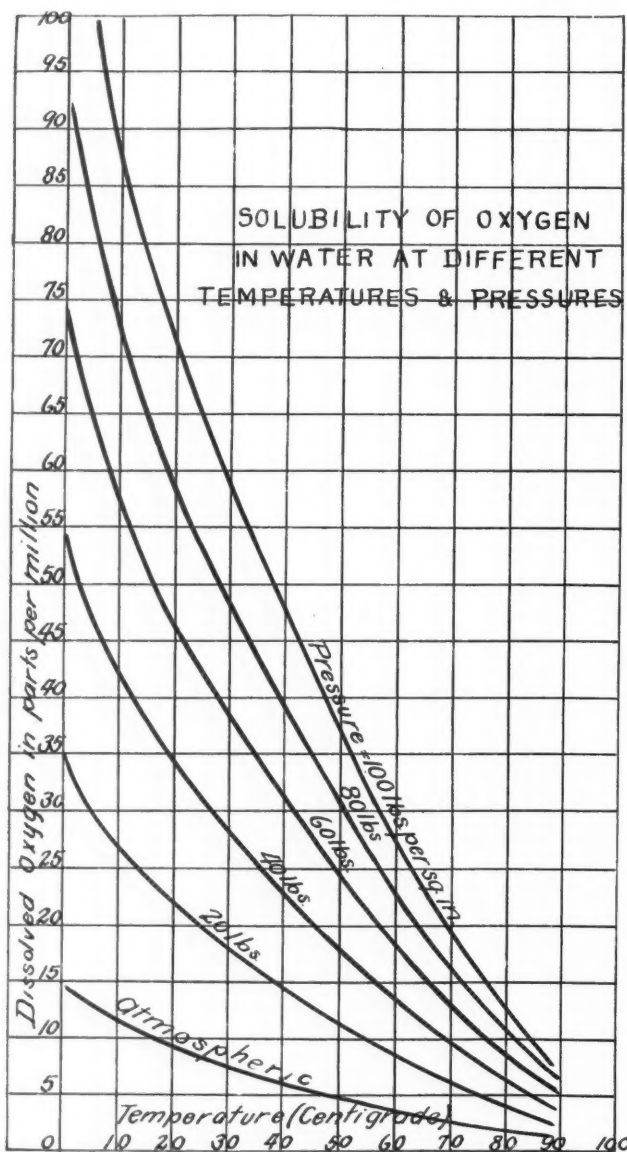


FIG. 2.—SOLUBILITY OF OXYGEN AT DIFFERENT TEMPERATURES

ence to the nature of the water. Practice can follow theory to a certain extent.

There seems to be no doubt that the most effective method of avoiding rusty hot water is to use brass or some metal other than iron or steel for the hot-water pipes and boilers. This increases the expense of the installation, but with very soft waters it is advisable. If brass is used it should be properly alloyed and well annealed, proper fittings also should be used.

If wrought-iron or steel pipes are used they should be of the best quality and should be well protected by a galvanized coating of pure zinc applied by the dipping method. Experience appears to indicate that wrought-iron pipes of the best grade resist corrosion better than steel pipes, but so many exceptions have been found to this that it cannot be considered as definitely established. Poor grades of both steel and iron pipe are to be avoided. A vigorous reform should be instituted in the manufacture and methods of branding and sale of smaller sized pipe for use with hot water.

In domestic hot-water supplies it is not feasible to prevent circulation of the water in the pipes, nor is this desirable, as the circulating system possesses a number of distinct advantages. The pressure of the hot water must depend chiefly upon practical physical conditions, but in designing a system where red-water troubles are feared, low pressure should be favored. There seems to be no doubt that in many cases the temperature of the hot-water supply is maintained higher than is necessary for domestic uses, and in such cases the red-water plague could be materially alleviated if means were taken to prevent excessive heating.

Neither is it feasible nor desirable to remove the dissolved oxygen from a public water supply as has been recommended for the Coolgardie supply in Australia. It is sometimes done in the case of water used for boiler purposes and the results are said to be beneficial. There is no reason why it could not be done for hot-water installations in large buildings, as in apartments, hotels and office buildings, where large numbers of taps are supplied from a common source. By first heating the water to a rather high degree, say 80 degrees to 90 degrees Centigrade, and then carrying it to an open tank at the top of its building a large amount of the dissolved oxygen would be liberated and its corrosive power materially diminished. A more complete removal might be obtained by the use of a closed storage tank with a partial vacuum.

The most effective method of preventing rusty hot water, next to the avoidance of iron and steel pipe, is to reduce the hydrogen ions in the hot water to a minimum or, what amounts to the same thing, to increase the relative number of hydroxyl ions. This practically amounts to saying that the public water supply should not be too soft. Experience seems to indicate that the alkalinity should be at least 10 or 15 parts per million. The higher the alkalinity the less danger of rusty hot water. But it must be remembered that the hardness of water is in itself objectionable and that when it is more than 15 or 25 parts per million it begins to have a noticeable effect on the use of soap.

Public water supplies high in organic matter and low in alkalinity may be advantageously hardened by the addition of a small quantity of lime, say 10 or 15 parts per million. This practice has long been common in England.

The use of alum with soft, colored waters should be avoided as far as possible, but if it is employed lime (or soda) should be used with the alum in order to prevent the alkalinity from falling too low. But here again is a difficulty, for when deeply stained waters are decolorized with alum it is found that the additional use of lime and soda prevents to some extent the satisfactory decolorization of the water. In such cases considerable care must be used in adjusting the chemicals, and in the present state of the art it is not always possible to obtain entirely satisfactory results. The problem of color removal for soft waters has not yet been satisfactorily solved.

With hard waters practically no precautions are necessary to

be taken, as the hardness itself seems to be sufficient to prevent rusty water troubles.

Finally, it is evident that the problem of rusty hot water is a complicated one. Its solution demands the united efforts of water works engineers, plumbers and pipe manufacturers. Economy to the householder demands that the quality of a public water supply be considered not alone from the hygienic standpoint, but from its possible influence on pipes and fixtures, and that, on the other hand, the materials used for distributing the water be chosen with reference to the inherent qualities of the naturally available supply. Plumbing regulations should be drawn with this in mind. But all these precautions will be of no avail if pipes of satisfactory quality cannot be obtained and recognized by the ordinary dealer and plumber. To this end two things are necessary, properly drawn specifications and a simple method of branding.

ILLINOIS WATER SURVEY

A BILL has just been signed by the Governor of Illinois adding to the duties of the State Water Survey an inspection of the water sheds of all of the municipal supplies of the state, making such field studies and collecting such samples as are necessary; also "To analyze and test samples and to make any investigations to the end that a pure and adequate public water supply for domestic and manufacturing purposes may be maintained in each municipality; to make sanitary analysis free of charge of samples of water from municipal water supplies or from private wells collected according to the direction of the State Water Survey; and to report the result of such examination to the Board of Health, Superintendent of Water Works, or other officer or officers of the water department of the city, village or incorporated town, or to citizens by whom the samples, respectively, were collected." The bill provides for an annual appropriation of \$15,000 for the salaries of the assistants and employees and for the expenses of this work. The Survey is directed to publish an annual report and such special reports as may be necessary. The University of Illinois was practically constituted the State Water Survey when it was originally established, Professor Edward Bartow being the director of the Survey.

MULTIPLE FILTRATION

In a paper read last month before the Association of Water Engineers of England, Walter Clemence referred to the increasing number of slow sand filtration plants in which the water receives as preliminary treatment either clarification in settling tanks or storage reservoirs, or precipitation with coagulants. Each of these methods is expensive, the coagulant is liable to cause clogging of the filter, as are also algæ and other micro-organisms which form in many of the storage reservoirs or basins used as settling tanks. Reference is made to the London water supply, of which Dr. Houston states that at certain times the life of the filter beds treating stored water is reduced to a few days only, because of the large quantities of algæ growing therein.

In place of precipitation, coagulation or storage Mr. Clemence advocates multiple filtration. The principle of this, he states, is founded on the idea that the formation of a film or *schmutzdecke*, either natural or artificial, on the surface of the filtering medium is neither necessary nor desirable. In this multiple filtration the coarse prefilters are so operated that chemical purification and bacterial reduction are effected to such a degree that no *schmutzdecke* is formed on the final filter. Meantime the water is exposed to the air in fountains or cascades in passing from one filter to the other and the aeration thus effected results in a partial replacing of the dissolved oxygen which had been lost in passing through the preliminary filters.

He suggests that should this absence of the film from the final, finest grained filter result in lowered efficiency of bacterial removal, sterilization by hypochlorite, ozone, ultra-violet rays or other modern methods might be necessary or at least advisable.

WATER WORKS NOTES

THE superintendent of the Bradford, Pa., water department, S. D. Heffner, reports that on Jan. 1, 1911, a satisfactory reduction in their fire insurance rates was made by the fire insurance companies on all properties in the city, in accordance with an agreement with the underwriters made some time ago. This agreement was that if the city would erect a good and substantial pumping plant within the city limits and maintain it ready for instant use at all times as an auxiliary to the gravity system, the insurance rates would be lowered. A reduction has accordingly been made of from 25 to 50 per cent. in the insurance rates.

The same city also reports that the use of fire hydrants by sprinkling carts continues to be a nuisance of the worst kind "not only to the water department but to the public generally as well, by stirring up the sediment in the mains and thereby causing roily water." There are a number of most serious objections to the use of fire hydrants by sprinkling carts, but we do not remember having heard this one before. If the mains are so filled with sediment as this report would apparently indicate it seems to us that the department should blow off all the fire hydrants at frequent intervals, whenever there is sufficient water to render this expedient and thus remove the real cause of the roily water.

Summerville, Mass., had on Dec. 31, 1910, 12,149 service connections and 5,810 meters. Water Commissioner Frank E. Merrill in his annual report states that, although \$4,632.73 was spent during the year in installing meters, almost the whole of this amount was saved in the reduction of waste for that year alone. In this case the saving in consumption is an actual saving in dollars and cents and one which can be exactly computed, since the city obtains its supply from the Metropolitan system and pays the State commission by meter for the water consumed.

Of the 5,810 meters, 228, or about 4 per cent. of the entire installation, were found out of order during the year and repairs to the same made in the department repair shop. The defects found are classified as follows: Broken disks, 38; defective registers, 15; defective gear trains, 47; freezing, 46; hot water, 5; dirt, sedimentation and similar obstructions, 42; miscellaneous defects in gears, spindles, screens, etc., inside the meters, 23; noisy meters, 12.

Probably owing to a considerable extent to the introduction of a new water supply under a somewhat higher pressure than the old, the city of Springfield, Mass., suffered from a considerable number of leaks during the year 1910. Altogether there were 76 leaks in the mains, an average of 0.41 per mile of main pipe in use. Two of these were somewhat unusual. In March a 24-inch by 8-inch reducer blew out, causing a flooding of cellars in the vicinity, breaking a 12-inch gas main and a street railway wire duct, filling the gas mains and wire ducts with water and sand and doing much other damage. Fortunately, a number of teams and automobiles were immediately available and the necessary gates were closed in less than half an hour. The peculiar feature was that the reducer which was blown off could not be found and Superintendent Alfred E. Martin reports his belief that it evidently had sunk into the quicksand which is found quite generally in that vicinity, having entirely disappeared from sight before the hole was cleared of water. Fortunately, another was found at Hartford which could be obtained at once and was got on the ground so quickly that the repairs were completed the next day.

Another serious break occurred on the afternoon of July 4, a hole about 6 inches in diameter being blown out of the side of an 8-inch cement-lined main, forcing a stream of water out of the ground at an angle of about 45 degrees and completely deluging a dwelling house on the south side of the street, injuring the house badly and ruining much of the furniture and clothing of the tenants. The house was literally bombarded with trap rock and sand, all the front windows were broken, clapboards and shingles were torn off and the front room floors were covered to a depth of 3 to 4 inches with sand and gravel.

PUBLIC WORKS NOTES OF READING, PA.

In his report for the year 1910, city engineer Edmond B. Ulrich, of Reading, Pa., calls attention to the inconvenience of having the fiscal year begin on April 1st, with the new appropriations taking effect at the same time; since, although they take effect then, there is no actual money available for expenditure before the middle of June or the first of July. "In making this statement recognition is taken of the fact that there is always some money left from the previous year through unexpended appropriation and accumulations of some amount in different general funds. This lack of money for a period of nearly three months is a serious set back to all our construction work especially on highways, as it thus leaves but about 5½ months before the opening of the next winter, and all our construction and repair work must be done in this time. . . . Where laws relative to the beginning of the fiscal year and the collection of taxes are not beneficial to conditions as they exist, such laws should be amended to be made so."

STREET OBSTRUCTION BY BUILDING MATERIAL

The piling of building material directly upon paved streets is considered a nuisance by the city engineer, and he recommends legislation requiring that proper receptacles be constructed in which all building materials should be kept until used, or excavated and worthless material stored until carted away. "The object is to prevent the disagreeable sight of sand, loam, plaster, stone chips, wood and other materials being scattered over the square through various causes—by wheels of teams, water flowing in gutters, wind or rain, and also to avoid the additional wear of the pavement due to the grinding action of the wheels of each wagon as it goes over the scattered material."

SIDEWALK GUTTERS

The method in vogue in Reading, of conducting storm and waste water over the sidewalk surface by means of shallow gutters from building to curb line is considered objectionable and it is recommended that it should be prohibited as being both unsanitary, unsightly and dangerous to pedestrians, especially in winter. All water which it is necessary to carry from the building to the gutter should, it is believed, be carried through pipe drains placed under the sidewalk.

STREET CLEANING

A contract has been let by the city for cleaning the paved streets for a term of years ending June 6, 1911. On March 2, 1910, however, the contractor abandoned his contract without previous warning. On the following day the city, having decided to complete the term of the contract with its own forces, ordered the necessary equipment and on March 4 had 15 men at work sweeping the dirt into piles near the curb lines of the streets, to be later carted away in wagons. This was adopted as a temporary expedient only until the arrival of the carts, shovels, brooms and other equipment. When these had arrived each cleaner, who has been assigned to one of the 24 districts, was equipped with a broom, shovel, scraper (if there were asphalt streets in his section), either three or four cans and a can carrier, to which was added a pick during winter months.

The cans were made from No. 18 steel sheets and were 19 inches in diameter at top, 15¼ inches at the bottom and 23 inches deep, each can holding 3 cubic feet of sweepings. These cans are filled in succession and then placed at a designated spot in each district, from which points they are removed by the street cleaning wagons, of which there are three. The brooms employed were 20-inch bass and lasted an average of 48 days. The shovels lasted an average of 4½ months. The cost during the ten months of operation was \$7.88 per square for cleaning and 43 cents for flushing, or a total of \$8.31. The contract price had been \$7.59. The total amounts expended for cleaning during the ten months were as follows: Foreman, \$807; labor, \$9,720.29; teams, \$3,151.36, and for flushing labor, \$399.70, and for flushing cart, \$207.13. The regular cleaning force consisted of one foreman, 24 district cleaners and three teams.

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JUNE 14, 1911.

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Water Works Rate Making

There would seem to be some significance in the fact that two of the most important papers delivered before the American Water Works Association last week dealt with the subjects of rates for water and for fire protection. Mr. Earl makes a plea for water rates established upon a foundation of facts and reason rather than an unsystematic and irrational set of rates based upon guess work and an estimate of what the consumers will pay, as has in the past been the more common plan. Similarly Messrs. Metcalf, Kuichling and Hawley have developed a method of fixing hydrant rentals which is based upon the cost to the water department or company of the fire protection furnished, rather than a comparison with rates in other cities or the plan of exchanging it for a franchise or other considerations offered by a municipality in which neither party has any idea as to which is more favored by the exchange.

Several members of the Association took exception to Mr.

Earl's idea of charging a uniform rate for water consumed, regardless of the amount taken by the consumer; maintaining that large consumers should receive special rates or discounts, as is common in the mercantile world. In this we believe that the objectors were influenced by their familiarity with previous methods rather than by reason. Large purchasers of merchandise of any kind are usually favored because the cost of securing the order, of entering the item upon the books, of collection, etc., is little greater for a large order than for a small one, and in general because the fixed charges are nearly the same for each order regardless of its size; with the additional reason that in many cases the cost of carrying and delivery are less per unit for large quantities than for small. There is in addition the idea in many cases that the amount of profit involved is so large that rather than lose it all the seller would reduce the unit profit. In the case of water supply, once having placed the connection and meter, the unit cost is no less for furnishing large quantities of water than for furnishing small, aside from the cost of maintaining the meter and connection in order, keeping the books and collecting the bills. Mr. Earl's method provides that these items of variable cost just referred to should be charged to the consumer at their actual cost plus a reasonable percentage of profit; and in these variables we find the parallel to the additional discount offered to large purchasers of other classes of merchandise.

There remains the argument in favor of sliding rates for the water consumed item that, if large consumers are not favored they may construct a water system of their own, or locate in some other city; and there is perhaps some reason for this in certain cases. If, however, the rates are established according to Mr. Earl's method, the rebate or discount to large consumers could not be very considerable unless the water were furnished at an actual loss. There is the counter-argument, which is especially applicable to municipal supplies, that the smallest consumers are generally the least wealthy ones and that consequently they should have the advantage of as low rates as any.

There is an additional reason frequently urged for municipal supplies, that low water rates will invite manufacturing plants to the city, or that high rates will drive out those already there; and that the presence of these establishments is of considerable value to the city. This is perfectly true, but a reduction in rates made for this reason becomes in effect a bonus offered to the company, just as some cities offer free land or no taxes. To conceal this bonus under the guise of low rates is to retain the unscientific and indefinite methods which it is the very purpose of the new methods of rate making to eliminate. If it is desired to offer such bonus, let it be done openly, the water department being credited with the regular rate and the difference being made up by a credit from the public treasury or payment by the local Board of Trade or whatever organization stands sponsor for the bonuses of other kinds offered.

The authors of the papers on fire hydrant rates state near the beginning of their paper that rates should lie somewhere between the cost of supplying the service and the value of such service to those who benefit by it. They outline a method for determining with more or less accuracy, the cost of the service and give some figures indicating the value of such service. However, in the rates suggested by them they do not appear to have taken any account of the latter. It is possible that we have not fully apprehended their idea, and that what they had in mind was that the charge should be based upon the cost, but that it should not be greater than the service rendered; and if it is greater than the value of such service, then either the cost of rendering the service should be reduced, the value of the service should be increased, or there should be no effort to render the service at all. This appears to us to be the proper basis; and the authors have apparently shown that the service rendered by fire protection is considerably greater than the cost, and have therefore justified the continuation of such service.

The authors of both papers have called attention to one important matter—the necessity for keeping such cost records by water departments and companies that it will be possible

to determine the itemized cost of each service, and pro-rate all expenses to the proper items of service rendered. Without such systematic book-keeping, combined with an accurate knowledge and careful interpretation of the various elements of cost, it will not be possible to establish rational rates for either water consumption or fire protection. Such systems of book-keeping have been urged by us for some time past, as have also the general methods of rate making so excellently developed by the authors of these papers; and we are glad to see evidences of a more general acceptance of these ideas.

Esthetic and Commercial Characteristics

The abstract of Mr. Whipple's paper in this issue calls attention to one of the characteristics of a water supply which is not directly connected with its effect upon the health of consumers, and incidentally illustrates the proposition that water works superintendents and engineers are expected by the consumers to consider what are sometimes called the esthetic features of the supply and those which affect its usefulness for commercial purposes. During the past few years so much attention has been paid to the treatment of water with the sole or chief purpose of rendering it safe, that many appear to have lost sight of the fact that consumers are entitled to have due consideration paid to their natural desires for a clear and colorless water, one which is not so hard as to require an extravagant use of soap or cause incrustations in boilers and cooking utensils, and for absence of other mineral substances, acids or alkalies which would cause a destruction of pipes and plumbing, the "red water evil," or affect the taste or odor to a perceptible degree. If one or more of these objectionable features are found to be introduced by the use of alum hypochlorite, or other agents used in water purification, then some remedy for this should be found or substitutes for these processes adopted. A great argument in favor of slow sand filtration is that there appear to be few, if any, offsetting objections to its use; and for the same reason it would appear that ozone would be a most desirable sterilizing agent if some method for utilizing it could be discovered which is physically and commercially practical.

STERILIZING BY ULTRA-VIOLET RAYS

CONSIDERABLE has appeared in the European and English papers during the past year concerning a new method of sterilizing water by the use of ultra-violet rays; but the practicability, both physical and financial, of the method seems as yet to be so far from commending it for use in actual service that little has been said about it in this country except as a matter of scientific interest rather than of engineering. In a paper before the Association of Water Engineers of England Max de Recklinghausen described experiments conducted by him at Sorbonne University, in which water containing *B. coli* was sterilized by a 220-volt, three-ampere silica lamp, sterilization being obtained within one second at a distance of 10 centimeters, within 4 seconds at 20 centimeters, within 15 seconds at 40 centimeters and within 30 seconds at 60 centimeters. Temperature was found to have little effect upon the speed of sterilization, even including the freezing point.

Experiments with various classes of micro-organisms showed that they varied in their sensitiveness to the action of the rays. Destruction was found to take place in the following times at a uniform distance. *Staphylococcus*, 5 to 10 seconds; *cholera*, 10 to 15; *coli*, 15 to 20; *typhoid*, 10 to 20; *dysentery*, 10 to 20; *pneumonia*, 20 to 30; *subtilis*, 30 to 60; *tetanus*, 20 to 60. Glass was found to be practically an absorbent of the ultra-violet rays and therefore must not be interposed between the rays and water.

In the city of Marseilles water previously clarified by multiple filtration is said to have been treated with ultra-violet rays with some measure of success.

From the above it would appear that water which is to be sterilized must remain within 20 centimeters (about 8 inches) of the lamp for at least 4 seconds, or within 4 inches of the lamp for at least one second, and that glass must not be interposed between the lamp and the water. This would apparently

require either very low velocities or a great number of sources of ultra-violet rays placed within 2 or 3 inches of each other throughout the channel through which the water to be sterilized is to be passed.

Concerning the cost of this method it is stated by Dr. Rideal that slow sand filtration would cost about \$10.40 per 1,000,000 gallons, rapid sand filtration about \$11.60, ozone \$16.40, and ultra-violet rays \$125 to \$175.

STANDARDS OF PURITY

THE vice-president of the Society of Engineers of England, H. C. H. Shenton, in a paper read before that society last month concerning standards of purity for water supplies expressed ideas which would not be endorsed by most American engineers. One of these is an assumption that chemists and bacteriologists have attempted to fix, and are to be criticised if they do not fix, standards of purity to be adopted by Boards of Health and water works officials, and to which engineers must attain in their works and processes for the purification of water. Add to this assumption the additional one that it is the duty of the engineer to bring all potable water supplies to whatever theoretical standard may be set up, regardless of what the difficulties and expenses may be, and we find Mr. Shenton proposing a basis of conduct for the water works engineer which would not be subscribed to by many engineers or even experts in pure science in this country.

Mr. Shenton devotes a considerable part of his paper to references to conflicting views held by engineers and others concerning the reliability of the coli test as indicating the safety or the reverse of a water supply, with a side glance at the possibility of there being water-borne bacteria other than *cholera* and *typhoid* bacilli which are more or less inimical to the health of human beings. Dr. Thresh he refers to as being "evidently of the opinion that water may contain many harmful organisms besides the typhoid or *cholera* bacillus, and that it is quite probable that impure water is to blame for many minor illnesses, owing to the presence of organisms as yet undetected or undefined." Such a conclusion has already been reached in this country and has formed the subject of several articles and papers during the past year or two. This, of course, does not reflect in any way upon the coli test, but merely indicates that such test is not altogether sufficient and that in time there will probably be discovered other hostile bacteria or pathogenic matter in water than are yet recognized.

Concerning the coli test he quoted Dr. Dibdin as saying, "To condemn a water which shows no sign of contamination other than a few *B. coli communis* and gives negative results to all tests for other objectionable bacteria, and also fails to respond to the most delicate chemical and microscopical tests for those substances which are known to be present in sewage polluted waters; a water, in fact, which exhibits all the characteristics of an exceedingly pure water, except for the presence of the aforesaid few *B. coli*—to condemn such a water is rash in the extreme."

As an illustration of the minimizing of the importance of coli, reference is made to John R. Downs, physiologist to the United States government, who found the water supply from certain water sheds to contain coli although these water sheds had been completely depopulated, the roads diverted from them and pollution prevented by police inspection. In this case Mr. Downs had attributed the presence of coli to birds and small animals on the water shed and concluded that their presence was not necessarily an indication of dangerous conditions; although in some samples coli were found present in one-half c.c. Mr. Shenton also quotes a number of authorities who have expressed their belief in the value of the coli test, and seems to consider the two classes of statements and opinions contradictory, expressing himself as follows:

In the face of the evidence given above as to the danger indicated by the presence of coli, it is begging the question to assume that any water is safe when coli are found in it in such large numbers (as found by Mr. Downs). In one case we have Professor Starkey demonstrating that water which

could not be found to contain coli in a sample of less than 100 c.c. actually produced disease, and in the other we have Mr. Downs ready to ignore their presence in one-half a c.c., merely because he has no reason to believe that the water is polluted. Surely, if such views are to be accepted as correct, not only does the coli standard become absolutely useless, but the work of the chemist and of the bacteriologist becomes useless also; all that is required is a person possessing common sense to look around and see that the water is not grossly polluted. . . . Until some standard for all cases is fixed the position of the scientist at the present time practically amounts to this: Tell me the source from which the water comes and show me whether it is polluted or not and whether it has produced diseases or not, and I will then adapt my standard to suit the requirements of the sample in question. If I do not see any obvious causes for pollution I will allow you to have coli in one-half a c.c.; but if I think that there is any risk of pollution I will demand the absolute absence of coli from 100 c.c. or from 1000 c.c., for that matter.

Mr. Shenton states that his object in writing this paper was to "attempt to bring home to the chemist and bacteriologist the impossibility under present conditions of agreeing upon any standard, conformation with which should prove that water is incapable of producing diseases in a greater or less degree. What they can do, and what they ought to do, is to fix a standard which should prove that the water is free from given definite organisms believed to be harmful. Thus, if absence of coli were insisted upon, one might be reasonably sure that typhoid germs were absent; but according to the statements of the scientists quoted above, absence of coli does not necessarily prove the absence of certain other organisms, more or less indefinite at present, which they believe to be harmful in a minor degree. With regard to coli, typhoid, and other well defined water-borne disease germs, there is no such difficulty. If the scientist believes that they should be excluded, he should say so in no uncertain manner. If the scientist will fix his standard we, as engineers, are prepared to make any water conform to that standard."

Concerning the pollution of streams he states:

Although it is possible to purify water to any required degree, this does not afford the slightest excuse for acquiescing in the pollution of water supplies. Here, again, it rests with the medical authorities and with the chemist and bacteriologist to insist strictly and uniformly upon the prevention of pollution. If they will do so we, as engineers, are quite prepared to make all sewers, house connections and house drains as water tight as we make our water mains. We are prepared to do away with every soakage pit or cess pit in the country; we are prepared to purify all sewage discharged at outfall sewers up to any degree of chemical or bacterial purity required.

We cannot agree in any way with the attitude assumed by Mr. Shenton nor with most of the hypotheses upon which he has evidently based his discussion. By stating that the scientist should adopt a standard of purity which the engineer must live up to, he seems to assume that the engineer is not a scientist, and that he should himself have nothing to say about the adoption of the standard. This is by no means the conception of the duties and responsibilities of an engineer which are held in this country. On the other hand he seems to assume that it is possible for the engineer to reach perfection in both the construction of sewers and sewage works and in the purification of water. Theoretically this may be possible, but the engineering profession in this country certainly does not consider itself "quite prepared" to bring about such ideal conditions; and it is absolutely certain that it would not receive from municipal and other authorities the enormous financial backing requisite.

More important than this, however, are his remarks concerning the coli test, since they seem calculated to belittle the importance of this, and in fact, to assert that because an absolute and incontrovertible standard has not been fixed it seems useless to live up to such lights as we have. There would probably be no question by either Mr. Shenton, his "scientists" or engineers that the best test to make of water supplies would be one for the typhoid bacillus, the cholera bacillus, and the several other pathogenic bacteria, and other harmful matters, if there be any, and judge the water accordingly. Unfor-

tunately it has been found impossible to test for typhoid bacteria, both because of the limitations of our knowledge and because of the comparative infrequency of these even in sewage polluted waters. As to the other harmful organisms which may exist in the water, we have not even learned to identify these or to be positive that they exist at all. It therefore appears that such direct test as seems desirable is, in the present stage of our knowledge of bacteriology, impossible of attainment. It has, however, been found that all sewage teems with *B. coli*, and the detection of these has of recent years been made comparatively easy and certain. Unfortunately *B. coli* are voided from the intestines of many other animals besides human beings, and consequently the presence of them is not a sure indication of sewage pollution. Consequently, although the presence of quantities of *B. coli* should cast grave suspicions on the water, if, as in the case reported by Mr. Downs, investigation of the water shed shows that it is impossible that any such quantities of *B. coli*, if indeed any at all, could have been contributed by human beings, this evidence may be taken as even more positive and determining than the presence of the *B. coli*.

Even were the test for typhoid bacilli possible and certain, it would still be extremely undesirable to rely upon them, but something similar to the coli test would still be necessary. The reason for this is that it would be quite possible that the sewage of a certain town would not, for months at a time, contain a single typhoid bacillus, owing to the absence of cases of that disease in the city. And yet, with the occurring of a case of this disease such bacteria would probably be present in considerable quantities. Even daily tests of the water receiving this sewage, however, might not reveal this danger until there had possibly been several hours' flow of the typhoid-contaminated sewage. Therefore the standard test should be one which indicates the presence of sewage rather than merely the presence of typhoid bacteria.

The apparent effort of Mr. Shenton to belittle the coli test or else to reflect upon the sincerity or courage of their convictions of the engineers who believe in it, seems to us to be very unfortunate and one whose cause we cannot understand. The coli test has been and is of great value in determining whether there is ground for suspecting sewage pollution in a water supply; and it serves to give warning of any considerable change in conditions as to such pollution. It is not absolute nor infallible in its determinations; but neither are the judgments of any of the experts in engineering, medicine or other applied sciences in which we are compelled to place dependence. Neither engineers nor bacteriologists believe or claim that this test is all which is desired, but it is the best which science has yet to offer. To refuse to use it because it is not perfect would be childish; but to adopt it implicitly and close one's eyes to other tests and indications which may either confirm or refute this is to be criminally blind to the known facts of the case.

As to the readiness of engineers to live rigidly up to standards of theoretical perfection or even the desirability that they should do so, we believe there is little question among practical men. When mankind eats only sterilized food, breathes only air from which has been removed all dangerous dust, with its possible burden of tuberculosis germs and others, when every case of communicable disease is immediately isolated, when all flies and mosquitoes have been exterminated and many other more important sanitary reforms have been effected, then there will undoubtedly be included with these the removal of all danger due to the pollution of streams with sewage or to the existence in water supplies of the last faint trace of such pollution. But the preservation of life is not more important than living; and if all man's energies, resources and expenditures are to be devoted to the preservation of life he will, we fear, feel by that time that the life has ceased to be worth preserving. There is a reasonable limit to all things, even to the measures which should be taken for the preservation of life and health.

NEWS OF THE MUNICIPALITIES

Current Subjects of General Interest, Under Consideration by City Councils and Department Heads—Streets, Water Works, Lighting and Sanitary Matters—Fire and Police Items—Government and Finance

ROADS AND PAVEMENTS

Test Will Be Made of Paving Demand

Milwaukee, Wis.—A test suit to determine whether the city can force the Milwaukee Electric Railway & Light Company to lay new pavements between rails and one foot on each side, when a different pavement than that in use is desired, may be the result of action which will be recommended to the Council as an outcome of a meeting of the Committee on Streets and Alleys. On recommendation of Assistant City Attorney Williams, the committee decided to report for adoption a resolution compelling the street car company to pave its right of way on Twenty-seventh street, from Vliet street to North avenue, with bituminous material. According to J. G. Simmons, of the railway company, the action will be tested. Mr. Williams informed the committee that in his opinion the city had the right to compel the company to use any kind of pavement desired on this street under the 1900 franchise. Superintendent Simmons said that if the object was to have the company replace its cedar blocks there would be no dispute, as the company was willing to comply with such a request, for the reason that the street was now paved with this material. He further stated that the requirement to have traction companies pay for pavements was a legacy of the "horse and mule car" days, when the pavements were damaged considerably, but that now, as far as the companies were concerned, no pavement was necessary. He cited the practice in many cities, where the streets are sufficiently wide, of having grass between rails.

Cart System Will Be Used on County Pikes

Knoxville, Tenn.—The cart system of taking care of the roads in Knox county will first be tried upon the Tazewell and Jacksboro pikes, according to the action of the Knox County Road Commission at a recent meeting. If it works successfully, it will be placed on other pikes.

Delegation Views Atlantic City Paving

Long Branch, N. J.—A delegation of City Councilmen and other city officials and a committee of the Board of Trade visited Atlantic City recently for the purpose of inspecting streets and street paving. The visiting delegation was entertained by Atlantic City officials, particularly those identified with the engineering and street department. The visitors were conducted over a number of streets of bitulithic construction. One street in particular, now in course of construction, appealed most favorably to the visitors, as it could be seen in its various forms of completion. After ascertaining how the bitulithic pavement is laid, the committee was taken in automobiles to the paving company's plant, where the preparation and mixing of the material were fully explained. Streets that had been laid for several years were gone over. They were found to be even and unbroken, and appeared in the best of condition. The streets of Atlantic City have brick gutters, and this adds to the appearance as well as the durability of the construction.

Meet to Discuss Grade Crossings.

Dayton, Ohio.—A meeting of the special committee on grade crossings of the Chamber of Commerce with the representatives of the several railroads entering Dayton was held recently. City Engineer Cellarius told the body that the proposed improvement would cost about \$6,000,000, and would take about six years to complete. He also stated that should the improvement cause any change in the alignment of the different roads that it could not be forced. He said that according to statutes 63 per cent of the cost was to be borne by the railroads and the remainder by the city. Engineer Cellarius also said that a river having a rise and fall of from 15 to 20 feet would have to be considered in the proposal. According to those who attended the meeting the matter will be pushed from now on.

An Improvised Pressure Oil Sprinkler

Waterbury, Conn.—Superintendent of Streets Benjamin Chatfield and his assistants have converted an ordinary sprinkling wagon into a pressure distributor. An air pump is located at the back of the wagon, the power to operate it being taken from one of the rear wheels and transmitted to the pump by a series of chains and sprockets. There is a safety valve set to blow at 40 pounds and the pump may be thrown out of gear by a clutch. A hand pump at the top



Courtesy Waterbury Republican

PRESSURE OIL SPRINKLER USED IN WATERBURY

of the cart is used to transfer the oil from the supply wagon into the sprinkler. A strip of road either six or three feet wide may be oiled at one time. It is roughly estimated that two miles of road may be oiled in a day. A trough is let down below the sprinklers when crossing walks. A measuring device shows the amount of oil in the wagon, so that the proper amounts may be charged to each job. Three horses are used to draw the wagon.

Oiling Streets on Huge Scale

Yonkers, N. Y.—In the last two weeks three giant tanks of oil, each with a capacity of 6,000 gallons, have been received here, to spread on the macadam roads and all has been used up. Never in the history of Yonkers has oil been used for this purpose to such an extent, and the cost of flushing the streets will, therefore, be an item, in the expense of running the Department of Public Works, of unprecedented proportions. The reason for this situation is the abandonment of using water for sprinkling, in accordance with the recommendation of the Joint Water Committee, who considered that move would greatly conserve the city water supply. All the macadamized streets in the city are being oiled under the direction of Mr. William A. Coyle, who has looked after this branch of the work of the Department of Public Works since its inception, four years ago.

Property Owners Must Pay for Pavements

Spokane, Wash.—The proposition that the general fund of the city assist abutting property owners in paving streets to the city limits to connect up with county roads is frowned on by Commissioner of Finance Robert Fairley. Strong opposition by other city officials is advanced against the plan, which was a suggestion of City Engineer Morton McCartney recently at the chamber of commerce. It is practically certain, from indications at the city hall, that no such plan will be adopted by the City Commissioners, owing to the state of the general fund and the dangerous precedent which would be set.

SEWERAGE AND SANITATION

Plans Sewer Conference

Montclair, N. J.—Mayor Hinck, who is the leader in the movement to establish an independent sewage disposal system for the municipalities of Montclair, Orange, East Orange, Glen Ridge and Bloomfield, which have demurred at signing the agreement for the \$12,000,000 trunk sewer planned by the Passaic Valley Sewerage Commission, has announced his intention of calling a conference of the mayors, councils and boards of health of all the municipalities of this section of New Jersey, at which the project which he has in mind will be thoroughly discussed. Mayor Hinck believes that when the independent sewage disposal system is explained the opposition which has developed against the scheme in Bloomfield and Belleville will be removed. The authorities of Bloomfield and Belleville each have taken official action protesting against the proposed disposal plant being in either of those municipalities. The town of Montclair has acquired about sixty acres of land in Bloomfield and Belleville, on which it is proposed to establish a disposal plant, which, according to Mayor Hinck, may be operated without causing a nuisance to the communities in which it is situated. It is declared Mr. Hinck has opposed the participation of Montclair in the joint trunk sewer project because he says the method of assessment of cost, which is by ratables, is inequitable and unfair to this municipality.

Health Officer Orders Clean-up

Bay City, Mich.—Unscreened doors admitting swarms of germ-carrying flies and other evidences of absolute disregard of ordinary sanitary precautions which he promptly branded a menace to the public health were found by Dr. Edwin Goodwin, health officer, in an inspection last week of several business places. He had called at the places only a few days before with sweeping orders to improve conditions at once. Evidently, they did not anticipate such an early return, for little had been done toward carrying out his instructions. The health officer has declared war on unsanitary ice-cream makers, dairymen and butchers, and will make a rigid inspection as often as possible. Some places he already has visited several times because the proprietors are slow to remedy unsanitary conditions. All, however, have indicated a willingness to clean up and stay clean.

Open Sewers Menace Health

Racine, Wis.—Action is to be taken immediately by the local Board of Health to remedy unsanitary conditions existing in Root River, where the current at the present time is not sufficient to carry off the sewerage, thus menacing the health of people living in the vicinity. It is possible that the State Board of Health will also take action in the matter. The river is exceedingly low at the present time, sounding not over 14 inches near Sixth street bridge. The reason for the decreased depth is not known, but is thought to be the lowering of Lake Michigan and the consequent draining of the rivers by the Illinois Drainage Canal. It has been suggested as a remedy that a flushing sewer be built, similar to the one which the City of Milwaukee now operates, in order to keep the channel free from contamination. Action will also most likely be taken by the Health Board in regard to other sewers which are not built properly.

Sewage Disposal Plant Inspected

Washington, Pa.—Twenty-two members of the city councils of McKeesport, headed by Mayor H. L. Arthur, recently visited Washington for the purpose of inspecting Washington's up-to-date \$100,000 sewage disposal plant at Arden. The party of McKeesporters were taken in charge by some of the Washington officials and conveyed to the disposal plant. They put in a greater part of the afternoon there, and then after seeing as much of Washington as possible returned to the Tube City. McKeesport is confronted with a somewhat serious problem in the disposal of its sewage. At present the sewage is dumped into the Monongahela River, but this practice must be stopped, according to an edict of the State Health Department.

WATER SUPPLY

Artesian Wells Are Proposed for Washington, D. C.

Washington, D. C.—If a movement just inaugurated by the Federation of Citizens' Associations materializes the District Commissioners may ask Congress for an appropriation with which to dig a number of artesian wells in the District. President William McK. Clayton, of the Federation, says that the matter has been put up to the Commissioners and that the Engineering Department of the District government is now preparing a report on it. "The Federation believes," said President Clayton, "that artesian wells, located at certain points in the city, would accomplish a great deal of good, not only in providing cool water for poor families who cannot afford to buy ice, but in keeping many persons out of saloons." President Clayton said that a number of citizens and representatives of the clergy had assured the federation of their interest in the plan, and that as soon as a definite reply has been received from the Commissioners an effort will be made to bring strong pressure to bear to have the matter favorably acted upon.

Water Company Earns \$40,651.75

Louisville, Ky.—The condensed statement of the operation of the Louisville Water Company during the month of April, signed by Auditor John S. Morris and General Bookkeeper R. H. Gardner, shows an expense of \$4,730.16 for cleaning the basin and repairing the division wall, making the total expense during the month about \$4,000 more than the expense during April, 1910. During April the total income was over \$66,000 and the net earnings \$40,651.75, or \$1,216.33 less than in April, 1910. But for the extraordinary expense due to repairing the basin the net earnings in April, 1911, would have showed a large increase over the earnings of a year before. The statement shows that 263 employees were paid \$14,569.32 during the month and that the list of permanent employees numbers 133. Two private line connections were made, two gates put in old lines and 10,468 feet of pipe laid.

Underground Lake Found in Huntsville

Huntsville, Ala.—A large underground lake from which the Huntsville spring derives its water has been discovered under the public square and extending back an unknown distance, according to Engineer Nathan Buchanan, who has been making excavations for the city. It is the intention of the city to have the lake explored, if possible, with a view of ascertaining from which direction the water comes. The water is still and deep and is seen as far back under a ledge of rock as light can penetrate. Operations are being carried on under the city with the purpose of locating the main stream that supplies the spring and tracing it out beyond the city limits. This is believed to be entirely feasible.

Double Main Water System for Fire Safety Proposed

Dayton, O.—To use the old canal basin, with the hydraulic and its various other tributaries as the basis of a double main water system for fire service, is part of a novel and interesting plan for the city's fire safety which Councilman Charles Roehm, of the Ninth ward, is working out. The Councilman's suggestions, very timely in the light of the present water predicament in Dayton, are being discussed with considerable interest about the municipal offices. Councilman Roehm's scheme was designed when the N. C. R. Company recently published an illustrated pamphlet in the interest of abandoning the canal. Councilman Roehm's plan, in brief, is to use the canal as a main conduit with tributaries and branches connecting reservoirs at various parts of the city for water with which to fight fires. The Councilman's plans would not prohibit the parking of the property throughout the city as the conduits would need but a small portion of the park space. The fact that the canal winds through the very most congested portion of the city adds much to the feasibility of Councilman Roehm's plan. Fire experts and fire insurance companies have repeatedly pointed out the necessity of double mains in Dayton and the fool-hardiness of using drinking water mains for fire fighting.

Plenty of Water for Ogden People.

Ogden, Utah.—Work on the Cold Water canyon conduit has progressed so far as to permit the final closing of the pipe line, the last juncture being made at a point on the Farr property, near the lime kiln. None of the pipe joints have been covered as yet, the excavation between lengths having been left open until each length and joint can be thoroughly tested for leaks. These tests will be made at once, after which the water will be turned in from both the old line up Ogden canyon above the confluence of Cold Water creek, and the new line up Cold Water canyon, in order that that portion of the old line between the last point mentioned and the reservoir may be thoroughly overhauled and repaired. When this has been completed the city will be provided with two separate systems, each of which may be used individually and the water from either turned into one or both. At the top of the hill near the sanitarium, both lines converge into a three-foot line, which continues to the reservoir. The old reservoir No. 1 has been re-excavated and its banks remodelled and the work of concreting it throughout will commence soon. About 2,000 barrels of cement will be used and it will require about four weeks to place it in first-class condition. The capacity will be 7,000,000 gallons, which, with 13,000,000 gallons in the new reservoir No. 2 will furnish the city with a storage of 20,000,000 gallons of water. Both reservoirs will be kept practically full for protection against fire, yet with the new system of valves and connections either may be used while the other is being cleaned or repaired. An automatic overflow has been installed which will convey the surplus water back into Ogden river.

Water Works to Charge Less

Toledo, Ohio.—Property owners will save \$7000 per year as a result of a reduction for improvements in the Water Works Department announced by Service Director Cowell. In the past the department has been receiving \$12 for making a tap in a water main and in the future the price will be reduced to \$10. Director Cowell says that about 1500 taps were made in a year, which means \$3000 less to the property owners on this item alone. The city has been charging \$9 for water meters, which meant a profit, and this price will be reduced to \$7 per meter, which is the cost price to the city. Director Cowell says that no charge will be made for water connection improvements between the water main and the curb line, which the property owners have been forced to pay for in the past.

Water Company Cleans Dry Wells With Steam Pressure

Hutchinson, Kan.—Artificial geysers are made daily in Hutchinson now. The demonstrations are the result of the work of the water company to clean out some of the dry wells just west of their plant on West Sherman street. The wells are seventy feet deep and the clay had caked and refused to let the water through. It was decided to blow the wells with steam. The wells are six inches in diameter and the steam is put down in a two-inch pipe under a 200-pound pressure. Being so far down it is able to form a strong head under the water and when the power overcomes the pressure it shoots water, mud and rocks into the air to the height of seventy feet or more, while the explosion sounds like a dynamite blast. The water company is having good success with the system and will soon have the wells in running order.

Filtration Plant Is Praised by Russian Mayor

Philadelphia, Pa.—Asserting that the fame of the Torresdale filtration plant had spread throughout Europe and that he came here to inspect it to gain ideas for a similar plant to be built in Russia, at a cost of a million dollars, Ivan Begerow, Mayor of St. Petersburg, spent more than half a day in this city, afterward leaving for Pittsburgh. Traveling incognito, the Mayor, regarded as one of the most progressive Russians in the Czar's lands, was enthusiastic over the vast equipment at Torresdale and the facilities for purifying water in such quantities. "I have visited all the larger cities of Europe," he said, through an interpreter, Frederick H. Florinsky, a secretary, "and none of their filtration plants can compare with that of Philadelphia.

United States Government Experts Will Test Water Pipes

Erie, Pa.—Experts of the United States Government Bureau of Standards are coming to this city to make tests of the local water mains to determine the extent of the action of electrolysis in the pipes. Burton McCollum of Washington has arrived in the city to take up his work, and he will soon have a force of men with him. It is expected that the active work will commence about July 1, when a survey of all water pipes will be made. The experts come to Erie at the expense of the government and they will be given all possible assistance by the local Water Board.

Plan to Instal Meters to Prevent Waste

Muskogee, Okla.—The question of placing water meters on every house receiving the service has become a live issue in city hall quarters and Commissioner Fleming has issued orders that all new taps placed must be ordered. The action of the council in deciding to comply with the recommendation of Mr. Fleming in this respect and the action of the Commercial Club in endorsing it were more or less discussed and many business men called at the water department and talked the matter over with the commissioner. In cold figures it appears that the waste of water each year runs to about a hundred thousand dollars. In his statistics, Mr. Fleming points out that 3,500,000 gallons per day for four thousand services is a heavy toll for the money paid.

City Seeks Water Supply

Talladega, Ala.—The city is quietly looking around for a source of additional water supply. The water at present piped to consumers is from a bold limestone spring in the center of the city. But limestone water is objectionable to many and it is liable to cake in boilers and machinery. Besides this the continued growth of the city will eventually demand more water than the present source can supply. Several tentative propositions are pending. One of them is to dig an immense well or reservoir north of the city where freestone water abounds and pipe freestone water from this source. Another proposition is to run the water from Talladega creek at or near Cragdale.

STREET LIGHTING AND POWER

Town in Darkness

New Castle, Del.—New Castle owes the Delaware Water Improvement Company about \$10,000 for light and water. Some days ago a conference was held and City Treasurer Manlove was instructed to pay the company \$1,500 on account. The company refused to accept the cash and ordered the electric lights to be cut out. As a consequence the streets were in darkness.

Mayor Will Push Cheaper Gas Rates

Baltimore, Md.—Declaring his intention of proceeding as rapidly as possible with the city's attempt to get cheaper gas rates, Mayor Preston states that he would consider a compromise offer from the Consolidated Gas, Electric Light & Power Company only with the advice and counsel of his proposed advisory board of citizens and the Board of Estimates. For the present it is the intention of the Mayor to proceed with such investigations incident and preparatory to a regular hearing on the question before the Public Service Commission, and any proposition which the company might find agreeable as a compromise would have to originate with the Company.

Give Prize for City Light Design

Columbus, O.—J. William Thomas, a member of the firm of Howell & Thomas, architects, was awarded the \$50 prize offered by the retail merchants for the most appropriate design for a cluster light standard for the new system of lighting that is to be installed throughout the business section of the city, and for which the City Council has already made an appropriation. Mr. Thomas' design is built on the lines of a Greek cross. Four stems, starting from the base, gradually decrease in size, until the brackets which bear the lights are reached. Honorable mention was given to four others.

FIRE AND POLICE

New Fire Net Gives Satisfaction

Schenectady, N. Y.—The new fire life net, constructed by Captain Alberts, of the Hose Depot on North College street, has been given its first practical test in the rear of the Central Fire Station in the presence of Mayor Dur-yea, Commissioner McDonald, and Chief Yates. Bags of sand, weighing 130 pounds, were thrown from various heights and caught with ease in the new net. A feature of the net is that it can be built for about \$17, whereas the ordinary net costs from \$75 upwards. All who witnessed the demonstration were well pleased.

Birmingham to Have Twenty-four Motor Fire Engines

Birmingham, Ala.—With the placing of an order for nine Seagrave combination hose and chemical wagons, and the making of arrangements for nine more to be ordered a few months later, Birmingham promises to take the lead among American cities in the adoption of motor fire apparatus. The city already has in commission three Sea-



Courtesy Birmingham Age Herald.

TYPE OF COMBINATION WAGON ADOPTED FOR BIRMINGHAM

grave wagons similar to those ordered, two Webb machines and one auto fire engine. President Culpepper Exum, of the Board of Commissioners, figures that the efficiency of the Fire Department will be increased 40 per cent. and its running expenses reduced \$30,000 a year. The illustration shows one of the combination wagons in front of the old City Hall at Woodlawn, a suburb recently annexed to Birmingham.

Chief's \$3 Investment Brings Home \$5,000 Prize

Dallastown, Pa.—An investment of \$3 in a book of chances on an up-to-date hook and ladder truck taken by Leo Hollinger, chief engineer of the Rescue Fire Company, of Dallastown, at the Altoona Firemen's Convention, has won the \$5,000 prize.

Visit Neighboring City to See Test of Auto Truck

Paterson, N. J.—Commissioner Milson, of the Board of Public Works, and Fire Chief John Stagg, both of this city, were among the guests at the trial of the new auto truck in Passaic, and they were as pleased as the Passaic people with the manner in which the machine worked, inasmuch as a truck of the Paterson Department is to be converted in a similar manner. The machine was given the hardest kind of a test, in that it was driven over a 14 per cent. grade which was muddy after the rain of the preceding day.

Auto Engine Tested

Wilmington, Del.—For two and three-quarter hours the Red Streak of the Water Witch Fire Company was put through a test which caused the firemen present to wonder how the engine stood it, and at the finish, they almost shouted as W. M. Johnson, representing the National Board of Fire Underwriters, of No. 135 William street, New York, announced that it was the finest test of a like sized apparatus he ever held.

GOVERNMENT AND FINANCE

Reform Councils for Two Cities

Harrisburg, Pa.—The bill to provide small councils for the second-class cities of Pittsburg and Scranton was approved by Governor Tener. Under the terms of the bill, which was agreed to in the form of a conference committee report on the last day of the Legislature, the Councils of the two cities are ripped out of office and for Pittsburg there is provided a Council of nine, to be paid \$6,500 a year each, and for Scranton five, to be paid \$2,500 a year each. Governor Tener has appointed nine anti-Magee residents of Pittsburg to serve as members of the single Council of that city, as provided by the second-class city act. The Councilmen will serve until the first Monday of next January, their successors to be chosen at the November election. It is said that some members of the old Council in the city of Scranton will protest against the enactment on the ground that it is unconstitutional, and the matter may go to the Supreme Court.

Could Protect Funds of City by Publicity

Baltimore, Md.—It is advocated that a system of periodical financial statements by the city would protect its funds. Recently an employee of the city was charged with embezzling \$67,000. If the City Register, like the State Treasurer, was required to publish monthly statements of the amount of city cash on hand in each of the depository banks this could not have been possible. Monthly statements by the city as to the amount it claimed to have in each bank would naturally have been watched closely by the banks. If at any time in the period of two or three years during which the defalcations had occurred the city had claimed more cash in one bank than was actually on deposit, the bank would naturally have raised an objection. An objection would have started an investigation, and the thieving would have been stopped long before it was.

Commission Government Elections

Norwich, Conn.—By a majority of 387 the electorate turned down the commission form of government. Norwich is the first city in the State where the proposition has been put to a vote.

Mobile, Ala.—By a majority of 829 out of a total vote of 3,612 the city of Mobile adopted the commission form of government.

Kingsville, Tex.—In the election on the proposition of incorporating the city under a commission form of government, with Charles H. Flato for Mayor and Ben T. Laws and E. F. Wier for Commissioners, the proposition was defeated by two votes, the vote standing 125 for and 127 against.

Missoula, Mont.—By a majority of 279 votes the Des Moines commission form of government was adopted.

Ordinance Provides for Equitable Basis in Assessments

Spokane, Wash.—A new basis for the assessment of the cost of public improvements against the property benefited is provided for in a proposed ordinance drawn by the city legal department. The measure is based on the new State law which went into effect June 8. Instead of dividing the property 150 feet back from the street into three zones 50 feet each wide, as at present, for assessment purposes, the new law divides it into five zones or 30 feet each. At present the three 50-foot zones pay, respectively, 50, 30 and 20 per cent of the cost of the improvement. Under the new law the five zones will pay, respectively, 45, 25, 20, 10 and 5 per cent of the cost. This arrangement of assessment makes the strip of property fronting on the street to be improved and the property farthest away from the street pay less, while the property in between pays more than at present. The proposed ordinance provides, also, for the day labor system of doing improvement work, although bids by contractors on all jobs are required, whether the improvement is to be by day labor or not, to be decided after the bids are in. An important provision is the one requiring that the City Engineer's estimate shall be the basis for making up the assessment roll in cases where day labor is employed, thus allowing the assessment roll to be made up and passed before the work is completed.

STREET CLEANING AND REFUSE DISPOSAL

Would Clean City at Less Expense

Butte, Mont.—In the programme of economy in the Health and Street Departments that the present administration will attempt to inaugurate, municipal ownership of the city teams is to be a feature. A statement has recently been prepared by the City Clerk and submitted to the Mayor, showing that the cost of a team to the city is \$3.50 per day. Under the proposition of municipal ownership it is said the teams can be maintained for \$1 a day or less. The initial cost, that is, the cost of purchasing the teams and providing a stable for them, also is estimated. It is planned to purchase something like 25 teams. A more progressive and advanced plan now under advisement is that of furnishing the Fire Department with auto propelled equipment and using the fire horses in connection with the work on the streets and alleys. The assistance of the street car company has been asked. The more progressive plan contemplates a central point in the city to which all garbage and refuse gathered in the streets and alleys may be hauled and the hauling of this refuse to the city dumping grounds or crematory in ore cars, operated in the early hours of morning over the street railroad. The plan is not only feasible but will effect a saving of one-half over the plan in vogue.

Will Try New Idea in Street Cleaning.

Altoona, Pa.—Determined to make the forces and means at his command as effective as possible in keeping the streets of the city clean during summer Superintendent of Highways W. H. Fields has put in service half a dozen service patrol carts with cans, which will be used in the hand sweeping about the city. Accompanying each cart will be three cans, making 18 in all. One of the sources of complaint heretofore in connection with the street cleaning operations has arisen from the fact that the dirt has been swept on piles against the curb, where it has afterward been gathered up by the wagons and hauled away. In the mean time several hours were likely to elapse during which the dirt was apt to be blown about by the wind, causing much annoyance. Under the new system the men operating the carts will sweep until the can is full, and then it will be set to one side and another can used, the wagon in the mean time making the rounds and gathering up the cans. The cans are 24 in. high and will hold about two bushels.

Garbage Dump Making Trouble.

Williamsport, Pa.—For the fourth time within two weeks No. 2 Engine Company has been called to the garbage dump west of the Citizens' Electric Company. The frequent calling out of the company will probably result in the matter being taken up by Councils at the next meeting. City Solicitor Cummings was summoned to the dump and looked the place over thoroughly. Every time that the dump has broken into flames Jonas M. Fisher of the Citizens' Electric Company has asked that the engine and men be sent down and they have always responded. When they were busy with other work he would threaten to sue the city if they did not come. Chief Stryker is incensed over the matter. He says that the engine uses thousands of gallons of water and that even this will do no good, as the fire will soon break out again. The only thing to do, according to the chief, is to let the fire burn until it burns itself out, setting a watchman to guard it day and night. The flames are smouldering many feet under ground and cannot be reached by the hose. The chief is of the opinion that should there be many more calls of a similar nature the reservoirs will undergo a serious drain, and if there should be a drought the city may suffer.

Refuse to Pay For Cleanup

Greenfield, Ind.—A few weeks ago during a cleanup day in this city the mayor and street commissioner employed several men and teams to dispose of the rubbish and the commissioner's orders amounting to about \$50 were cashed for different persons by local merchants, who later presented the bills to the council, which allowed them. The clerk and treasurer refuse to issue or pay the warrants, contending they are illegal, although the city attorney has given a different opinion. They were advised by the state board of accounts that there is no fund from which to draw these bills and that they would be personally liable.

RAPID TRANSIT

Plans to Tax Street Cars

Topeka, Kan.—The taxing of street cars and all pole lines in Topeka is embodied in an ordinance now being drawn up by the city commissioners. It is planned to tax every street car in the city at \$25 each. The poles owned by the telephone, telegraph and electric light companies will be taxed at about 50 cents each. These figures have not been settled, but they seem to be the figures now chosen by city officials. The revenue from the street railway is proposed in order that the city might receive some sort of a tax from this company. The original franchise gives the city of Topeka nothing from the Topeka Railway Company for the operation of their lines in this city. It is figured by some of the commissioners that a tax of \$25 a car will be a means of gaining a revenue. The law provides that the city shall receive a certain per cent of the gross earnings, but nothing has been turned over to the treasury since the franchise was accepted many years ago.

Will Electrify Line on Getting Franchise

Salt Lake, Utah.—Plans are on foot to electrify the Salt-air line as soon as the City Council grants a franchise to come down Main street. Under the new arrangement, instead of discharging 2,500 passengers all at once at the West Second South street depot, 200 can be brought back from the lake at a time on interurban cars, and there will be no congestion in transferring to the city cars at various points along South Main street.

City Ownership of Street Railway Will Be Submitted to Vote

Detroit, Mich.—Again Detroit is to wrestle with the municipal ownership of street railways question. Right in the midst of the hot summer Mayor Thompson has announced that he wants the question submitted to the people this fall. A majority of the aldermen are with him on the proposition, and the question of the city buying the D. U. R. would undoubtedly be placed on the ballots at a special election, if it were not for the fact that legal steps will be taken to prevent such action by the city officials. Under the original home rule act, passed by the Legislature of 1909, petitions were circulated for the submission of the questions and the required number of names secured. But a suit was started by property owners to prevent the question going to the people and it was successful, the Supreme Court holding that no charter could be amended piecemeal under the home rule act until after there had been a general revision by a charter convention. At least that seemed to be the opinion of the Court, although a dozen interpretations were read into the decision. Corporation Counsel Hally contended that the defect in the home rule act could be cured by amendment, and he succeeded in securing the amendment he wished at the last session of the Legislature. But while the Legislature was doing that it also fixed up the act so that it will be almost impossible for the people to secure the submission of amendments by initiatory petitions, the law now compelling the securing of 25 per cent of the registered vote signed at the polls. But Mr. Hally contends that the aldermen may submit any question to the people at any time. Therefore the steps for the submission are now being taken in the Council. But the gentlemen who successfully fought the submission of municipal ownership before insist that no amendment to the home rule bill was sufficient to enable piecemeal charter amending and they are prepared to go into court and fight the proposition over again.

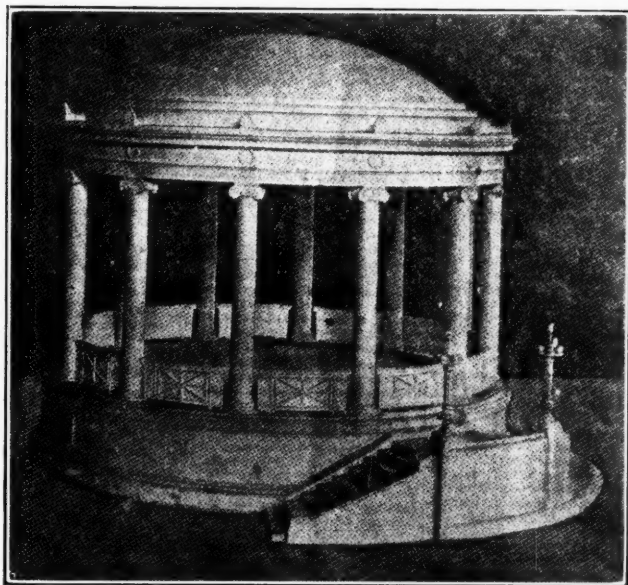
Electric Road to Accommodate Commuters

San Francisco, Cal.—It has been announced that preparations are being made for an electric road running between San Mateo and San Francisco, and that the plans would undoubtedly materialize, providing the proper sentiment was found to exist relative of a right-of-way through the cities of San Mateo and Hillsboro. The necessary capital has been secured for the undertaking, and it is proposed to establish express train service and grant commuters' rates. Those behind the project feel confident that there will be little difficulty in securing the desired right of way. This is a line that has been long desired by the residents of San Mateo.

MISCELLANEOUS

Band Stand for a Boston Park.

Boston, Mass.—A miniature model in plaster of the marble band stand that will be erected on Boston Common as a memorial to the city's benefactor, George F. Parkman, is on exhibition in Mayor Fitzgerald's office and has met with general approval. The stand will be built several hundred feet southwest of the existing structure, near Flagstaff hill, and the board of health has promised to take down the convenience station there and build another underground. The stand and pavement around it will cover about 3,000 square feet. The superstructure will be of pink marble and



MEMORIAL BAND STAND FOR BOSTON COMMON

the base of granite. The ceiling and floor will be inlaid work and there will be 12 perforated pillars of bronze. The architects, Derby, Robinson & Shepard, who won in the competition, have wrought in the spirit of the early Roman style, that of plain, chaste and delicate outlines, without a trace of modern ornamentation. The City Council appropriated \$50,000 from the Parkman fund several months ago for the band stand and other improvements for the Common. The stand will cost about \$25,000.

Playground Commission

Schenectady, N. Y.—Mayor Charles C. Duryee has decided to appoint a committee of five prominent citizens to investigate the subject of municipal playgrounds and report to him upon the advisability of working out a comprehensive plan for the establishment of such playgrounds and the enactment of the legislation necessary to establish them. The appointments will be made shortly.

Will Push Harbor Development of Chicago

Chicago, Ill.—Chicago harbor development has been stimulated following action by the Council when a resolution was adopted by unanimous vote directing the Harbor Committee to proceed without delay to draft an ordinance. Ald. Charles M. Foell, Republican, who has been pushing the harbor proposition for years, offered the resolution, which called attention to the enabling legislation obtained at Springfield for an absolute municipal ownership and controlled harbor. The tonnage of the port of Chicago proper has been declining annually for the last ten years or more, while that of all the other principal ports on the great lakes has been rapidly increasing. The Chicago Harbor Commission after a thorough and exhaustive study of the leading American and European ports, pointed out Chicago's inadequate and neglected harbor facilities as one of the principal causes of this decline, and recommended the immediate construction of piers extending into Lake Michigan as an indispensable means of rehabilitating the lake commerce.

Many Cities Plan Exhibits for Big Municipal Congress

Chicago, Ill.—Plans for the International Municipal Congress and Exposition, which will be held in Chicago next September, received a big boost last week when nearly sixty cities accepted invitations to participate in the big event and send exhibitions. The cities epitomize the enthusiasm and co-operation which is being shown in the congress. Controller William A. Prendergast, of New York, will contribute an address on municipal financial systems. His acceptance of the invitation has been received.

Prizes for Well Kept Lawns.

Cincinnati, O.—For several years the Hyde Park Business Club has arranged a contest and awarded prizes for the best kept lawns. This has induced individual effort and has resulted in producing many beautiful lawns. This year the sphere of influence is to be extended. Individual contests will be dropped and instead the unit to be considered will be a whole square, including both sides of the street between the nearest intersecting streets.

Mayors Will Gather to Honor Spokane's Executive

Tacoma, Wash.—Mayor W. W. Seymour is arranging for a gathering of the chief executives of all the cities west of the Cascades and a number of those east of the mountains at Seattle in June, in honor of Mayor Hindley of Spokane. The senior class of the University of Washington has chosen Mayor Hindley to preach the baccalaureate sermon, he having been a Congregational minister before entering political life last spring. Recently Mayor Seymour of Tacoma and Mayor George W. Dilling of Seattle decided that it would be a graceful compliment to the Spokane executive for a number of the mayors of Washington cities to attend.

Municipal Baseball Park is Proposed

Taunton, Mass.—Councilman Joseph L. Anthony is fostering a plan for a municipal baseball park for the use of schoolboy teams. Mr. Anthony put the plan before several of his brother members at City Hall after a meeting a day or two ago, and declared that if there was no law that stood in the way it would be a good investment. It would not be necessary to buy a lot, but as the councilman thinks, a place could be secured at a reasonable cost for the high school team on the days when they have the games and for the juvenile school organization at other times, the dates to be secured by application to the superintendent of schools or whoever might be designated in charge.

City Improvement Plans Exhibited

Albany, N. Y.—Drawings of the plan of Architect Marcus T. Reynolds, chairman of the Albany 1916 committee on river front improvement, have been placed in the office of William B. Jones, of the Chamber of Commerce, for inspection. President McKinney is expected to name a special committee of three within a few days to study the plans and report on them. The executive committee of the Albany 1916 movement, for which the plans were prepared, will also pass on them and report to the general committee. A new feature of the plans is the suggestion made for the acquisition of the block bounded by Broadway, Steuben, Columbia and James streets as a traffic square and trolley terminal. A circular plaza is provided for at the foot of State street, about which the trolley cars will circle. This will include the site bounded by State street, Broadway, Quay street and Hudson avenue. A system of concrete docks is proposed in the basin from Maiden lane to the steamboat square, with covered sheds and freight facilities. As these facilities are needed they can be extended southward. A sewage disposal plant is provided for to receive the sewage from the northern section of the city at the north end of the basin. This plant is to be covered by a little park. An ornamental lighthouse is provided for at each end of recreation pier. The south end of the present pier is to be cut away and a larger entrance made to the basin at the foot of Maiden lane for the entrance of the Troy boats. A system of lateral docks is provided for in the basin from Maiden lane south to the steamboat square, with covered sheds and freight facilities. A platform is to extend from the foot of State street to the recreation pier, curving to the north and run parallel to the Maiden lane bridge.

Bonds for Playgrounds

Columbus, O.—Columbus and other cities that take pride in their playgrounds and civic centers can rejoice over the action of the Governor in signing the bill legalizing bond issues for playground purposes and for recreation centers. The bill corrects an omission in the law by allowing councils to issue bonds for the above purposes. In Columbus the recreation bureau has been crippled for funds owing to the legal defect and has been compelled to postpone the opening of many of the summer playgrounds, bath houses and various civic centers. Money will be now available.

Children's Court Plan is Approved

Richmond, Va.—As a substitute for an ordinance referred providing for holding a special term of the Police Court in the afternoon twice a week for the trial of juvenile offenders, the Council Committee on Ordinance, Charter and Reform has recommended an ordinance strongly recommended by the Juvenile Protective Association and several other societies, which conforms to State laws recently enacted with regard to delinquent children. The first clause provides for the appointment of a special probation officer, preferably a woman, though the ordinance does not so state, the salary being placed at \$1,200. The second clause provides that the judge of the Hustings Court may designate three police officers for special service as probation officers in carrying out the work outlined, this power having already been given to the judge of the Hustings Court by State law. The third clause provides that in order that no child under seventeen years of age, when arrested for any offense, shall be confined in jail previous to trial, the Finance Committee is empowered to enter into a contract on a per diem basis, for the detention and care of such children, previous to trial, with some approved home of detention or charitable society having such powers under its charter. The fourth clause provides that the Police Justice of the city of Richmond shall hold a special session of his court every day at noon, whenever necessary, for the hearing of juvenile and non-support cases.

Deep Channel Plans Ready

Philadelphia, Pa.—Plans and specifications for the 35-foot channel from Philadelphia to the sea, the United States engineers announce, have been completed and proposals for starting the work on the Tinicum and New Castle Ranges will be opened soon, by Major Herbert Deakyn, United States engineer in charge of the deeper water improvements on the Delaware river and bay. The 35-foot channel project will insure deeper water and enough to float vessels of all sizes bound to and from Philadelphia's ports necessary for the increasing commerce.

Museum Buys Vinton Canvas

Boston, Mass.—Frederick P. Vinton's "Gray Landscape," painted in France several years ago and before he had practically abandoned his landscape work to devote himself to portraiture, has been purchased by the Boston Museum of Fine Arts. This is one of the first paintings to be bought with the fund of \$200,000 set aside for the purchase of pictures when Jean Guiffrey came over from the Louvre Museum to take charge of the department.

Experiments to Be Made in Planting Foreign Trees

Crowley, La.—The Rice Experiment Station has received fifty varieties of trees and shrubs, some of which are for ornamental purposes and others fruit-bearing trees, from the Department of Agriculture. They have been set out at the station with the object of ascertaining their adaptability to the soil and climate of the gulf coast. The Department of Agriculture will distribute samples of such of the trees and shrubs as are found suitable to this climate and soil.

No Rubber Stamps For Councilmen

Spokane, Wash.—The city commissioners have concurred in Commissioner Fassett's recommendation that the rubber stamp and pencil be abolished by city officials for signing papers which become a matter of record. Commissioner Coates is granted a special dispensation in being allowed to have his chief clerk sign the commissioner's name with a rubber stamp, by certifying it with his own name underneath.

Weed Campaign Ordered by Law

Spokane, Wash.—County officials, with assistance of the prosecuting attorney, will try to do away with the weed nuisance. After June 9 it will be a misdemeanor, punishable by a fine or imprisonment, for a property owner to allow noxious weeds to grow upon his property. Under the old law, which is still in force, the road overseer of each township is required to notify property owners to cut down and destroy the weeds growing on their property, such as Russian thistle, tumble weeds, "Jim Hill" mustard, cockle burrs and other weeds which may be detrimental to the agricultural interests. Upon the failure of the property owner to comply with the notice, the overseer is required to destroy the weeds himself and send a bill to the property owner. Upon failure of the property owner to pay the bill within 30 days, the overseer may present his claim for labor to the county commissioners, whereupon the claim is paid and taxed against the property, to be collected with taxes for the ensuing year. It also is a misdemeanor for the road overseer to fail, neglect, or refuse to enforce the law.

Concrete Foundation of Bridge Floats

Kansas City, Kan.—West Kansas avenue is carried across the Kaw River on a typical long span steel highway bridge, supported on steel caissons filled with concrete. Two of these steel caissons at a point well above flood waters began recently to swell in an unaccountable manner, until finally a sheet in one cylinder burst open. This was at first attributed to the action of severe frost, but it was soon observed that the contents of this cylinder was disintegrating with the jar of traffic on the bridge and gradually falling out of the rent in the steel sheets and floating away like pumice stone on the surface of the river. When a cavity of about 10 cubic feet was made in this way the authorities took steps to repair the piers. At the same time they started an investigation of this floating concrete, which is still in progress. While awaiting a full report it is interesting to note that on the bank of this river, not 500 feet from this bridge, is a large factory engaged in making a soap which floats, and its discharge sewer flows out almost under the bridge and at certain stages of the water deposits a white limelike sludge along the banks, which is often piled knee deep. A sample of this peculiar material was sent to the MUNICIPAL JOURNAL by Benjamin Brooks. The material is light, easily friable and somewhat resembles pumice stone and has few properties in common with ordinary concrete. A small piece thrown in water will float for a minute or two, gives out bubbles of air and finally sinks.

City Appropriates Money for Park Fetes

Rochester, N. Y.—Money for the water carnival in Genesee Valley Park on July 12, during the Shriners' convention, and for the big musical festival in Seneca Park in August, was appropriated by the Park Board at the regular monthly meeting. The sum set aside for the musical festival was \$1,500 and \$1,300 was the amount appropriated for the water carnival.

Mayor Favors Tax League and Investigation

Tacoma, Wash.—The proposition to organize a tax league and appoint a committee to investigate tax conditions of the city has been indorsed by Mayor Seymour. His indorsement of the plan was given to a committee from the Central Improvement League, which started the movement for the organization of a tax league. The committee asked Mayor Seymour to appoint at once a committee of five to investigate the city's taxes, budgets, levies and general taxation methods and make a report on its investigation. The Mayor was adverse to appointing such a committee at once. It would be difficult to find men willing to serve on such a committee without compensation, he said, and suggested that before a committee be appointed to begin the exhaustive work necessary to start investigating the city's books and taxation records that a fund be raised for payment of the investigating committee members. The Mayor also asked that other representative bodies and organizations be interested in the plan before requesting that he appoint the committee to investigate general taxation conditions in the city.

LEGAL NEWS

A Summary and Notes of Recent Decisions—Rulings of Interest to Municipalities

Defective Street—Injury—Sufficiency of Notice

City and County of Denver vs. Perkins.—A notice of injury to a traveler sufficiently designated the place in the street where she was injured as being on a named street, between two other streets, "where the sidewalk intersects the alley and where a curbing was being put in," and was not insufficient for not stating the particular side of the street.—Supreme Court of Colorado, 114 P. R., 484.

Extension of Water Mains—Indemnity

Town of Claremont vs. Rand et al.—An instrument reciting that the signers thereof agree to guarantee the 8 per cent. required by a town to extend a water main, executed after the town authorized the extension if the people along the line guaranteed 8 per cent. on the expense of extension guarantees an annual rental of 8 per cent. on the expenses of the extension. An action in assumpsit on the instrument against the signers thereof to recover the difference between the annual rental and the 8 per cent. of the cost of the extension is an adequate remedy and the town may not sue in equity.—Supreme Court of New Hampshire, 79 A. R., 689.

Water Company's Contract—Changing Rates

City of Independence v. Independence Waterworks Co.—A water company's charter constitutes a contract between the company and the city served which the city cannot alter without the company's consent. Where rates charged by a water company can be changed only by agreement between the company and the city, the company will be restrained from charging an increased rate agreed to by the city on condition that no meter rental charge be made, where the company refuses to abide such condition.—Kansas City Court of Appeals, 135 S. W. R., 956.

Private Fire Alarm Company—City Wires

Foy vs. City of New York et al.—The fire commissioner of the city of New York, in the absence of statute prohibiting it, has power to permit the Manhattan Fire Alarm Company in the discharge of its business to connect its wires with the city fire alarm telegraph system, so as to communicate an alarm of fire directly to fire headquarters, instead of compelling notice to be given by pulling the signal in the fire alarm box in the usual way, thus saving time, this not being the loaning or granting of property by the city to a private corporation.—New York Supreme Court, 129 N. Y. S., 72.

Mandatory Ministerial Duties

Mayor and Councilmen of City of Pawhuska vs. Pawhuska Oil & Gas Company et al.—The Constitution providing that after a franchise has been voted to be granted by a majority of the qualified electors voting thereon the same shall be granted by the proper authorities at the next regular meeting of the legislative body of the municipality, imposes upon the Mayor and Councilmen a mandatory ministerial duty. The writ of mandamus is available to require the performance of such duty.—Supreme Court of Oklahoma, 115 P. R., 353.

Municipal Contracts—Labor Laws

Ewen v. Thompson-Starrett Co. et al.—That the portion of a contract for the erection of a building for a city which provides for the furnishing of the stone work is sublet does not affect the question whether the work on the stone, which is done in another state, is subject to Labor Law regulating the wages to be paid workmen on public works or materials to be used in connection therewith. Labor Law, providing that workmen on public works or material used in connection therewith shall be paid the wages prevailing in the locality within the state where the public work in its completed form is to be situated, does not apply to work done out of the state on the material.—New York Supreme Court, 128 N. Y. S., 595.

Public Improvements—Bonds—Injunction

Clouse et al. vs. City of San Diego et al.—San Diego City Charter provides that the Common Council shall determine the necessity for public improvements and that where the ordinary revenues are insufficient bonds may be issued, the proceedings for which shall be in accordance with the general laws relating to municipal bonded debts, but the charter is silent as to how money so raised shall be spent. Held that in the silence of the charter, the expenditure of the money was not a "municipal affair" within constitution, providing that city charters shall be controlled by general laws, "except in municipal affairs," so that the general law followed as to the mode of issuing the bonds for the improvement, Laws 1901, was controlling, which forbids spending such funds, except on competitive bidding.

In an action by taxpayers to enjoin the making of public improvements for which city bonds had been sold otherwise than by contract, let by competition, an answer which charges that plaintiffs were contractors acting in collusion in order that some of them might obtain contracts for the proposed work and profit thereby, but which wholly fails to plead any facts showing collusion, is bad on demurrer.

The mere fact that a method of paying for municipal work which is contrary to the statute might be expensive and wasteful and might preclude responsible contractors from securing it gives a citizen of the municipality a sufficient standing to maintain an action for an injunction to prevent the illegal expenditure.—Supreme Court of California, 114 P. R., 573.

Streets—Extent of Dedication

Provident Trust Co. vs. City of Spokane.—A deed of dedication of a town plat recited that the grantors dedicated as public highways "the streets as marked and described on the foregoing plat," reserving "the strip of land twenty feet in width marked 'R. R.' for railway purposes," etc. Such strip occupied the space between two streets, both named and definitely marked on the plat as being a certain width each; the boundaries of the intervening strip being also definitely marked and its width being also shown on the plat. It appeared that in grading one of the streets the city did not enter on the strip, but constructed a retaining wall along the line thereof. Held, that the strip was not dedicated as part of the streets. An intention to dedicate will not be presumed, but must clearly appear. If the meaning of an instrument is doubtful, the practical construction given it by the parties will be accepted by the courts.—Supreme Court of Washington, 114 P. R., 1030.

Opening Surface of Streets—License Fee

City of Buffalo vs. Stevenson.—Buffalo ordinances providing that before any permits for the opening of a pavement shall be granted the applicant shall pay to the city treasurer \$5 for every such opening, to be credited to the street repair fund, and that any person who opens any street or alley without permission, or who shall fail to comply with any of the provisions of this section, shall forfeit and pay a penalty of \$10, is not in violation of constitution prohibiting the taking of private property for public use without just compensation, for the streets are within the control of the municipality.—New York Supreme Court, 129 N. Y. S., 125.

Boundaries—Extension—Procedure

McBee vs. Town of Springfield et al.—Since by Constitution as amended June 4, 1906, cities and towns are authorized to provide the manner of exercising the initiative and referendum powers in municipal legislation, except that not more than 10 per cent. of the legal voters may be required to order the referendum nor more than 15 per cent. to propose any measure by the initiative, which section is self-executing, no enabling act being required to put it into operation, the general law requiring cities and towns to provide by ordinance or charter the manner of exercising such powers is advisory only, and where the Town Council adopted the manner prescribed by Laws 1893, requiring a petition for change of boundaries to be signed by not less than 20 per cent. of the qualified electors, and submitted the question to the voters as provided by such section, this was a reasonable exercise of the power.—Supreme Court of Oregon, 774 P. R., 637.

EXHIBITS AT AMERICAN WATER WORKS CONVENTION

The exhibits made in connection with the 31st annual convention of the American Water Works Association, June 6-10, were displayed in the corridors and adjoining rooms of the Powers Hotel. The main corridor is perhaps 60 feet long and 20 feet wide. On both sides of this were tables on which the various devices were shown. The main corridor leads into an office or lobby perhaps 60 feet square. On two of the sides of this were arranged the exhibitors' tables and in two large rooms opening from the lobby besides. The unusual publicity given the exhibits had its advantages and disadvantages. Many people passing by the hotel were attracted by the show, so that in a way it had a popular feature and presumably accomplished some of the ends of a municipal budget exhibit. The many tables, covered with water meters of all sizes and descriptions, must have brought the matter of water conservation forcibly to the minds of many people who had hitherto given it little thought. Notwithstanding the publicity there was ample time and room for members of the association to study the devices they were interested in without serious interruption.

Water Meters

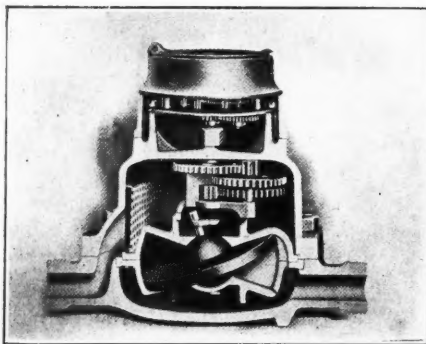
Water meters were the appliances most in evidence; perhaps the tables holding them occupied a third of the total floor space. Altogether, eleven meter manufacturers were represented. The total number of exhibitors of all devices was 53. In this account are not included the Pitometer and Venturi meter, although they, too, may be used for individual installations. The importance of the meter question was indicated also by the number of meter accessories, such as meter boxes, meter seals and meter testing machines. All sizes of meters from smallest to largest were shown. Complete meters were shown and meters taken apart showing the working mechanisms. In other instances the casing was cut away, showing sectional views. Photographs, diagrams and reading matter were also used to explain the strong points of each. The fact that the meters were not new in design—the writer only noticed one that was actually new—did not prevent them from being objects of considerable interest to the members of the association. In fact, there seemed to be a strong desire to learn details of design and construction of different meters, with a view to consideration of questions

of comparative accuracy and cost of maintenance.

Reproductions and brief descriptions of many of the meters shown follow.

Disc Meters.—A disc meter is a meter in which a hard rubber disc rotating in a chamber receives a definite quantity of water between the disc and the bottom of the chamber. This unit of water as the disc rotates is passed on around as chamber and out at an orifice near the point where the water enters. Nearly all house meters are disc meters.

The Badger meter is made by the Badger Meter Manufacturing Company, Milwaukee, Wis. One of the chief merits claimed for this meter is the frost bottom, which consists of a plate of soft gray cast iron, thoroughly galvanized and rust proof, with a low breaking strength of 600 pounds. In case the meter should be frozen the ice breaks the bottom plate, thus relieving all strain before the pressure has reached a point where it is dangerous to the interior parts. The bottom plate can be renewed at a cost of a few cents. The frost bottom is held firmly



BUFFALO

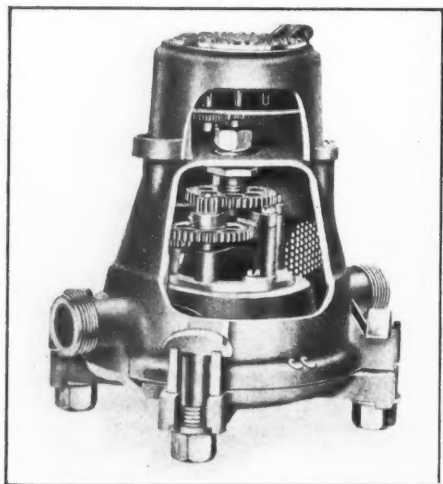
in place by means of four strong toggle bolts, which, when removed, expose the bottom of the measuring or disc chamber. All parts of the meter, except the bottom, are constructed of hard tough bronze. The intermediate train gears, pinion gears and pinion rods are of phosphor bronze.

The Buffalo Meter Co., Buffalo, N. Y., exhibited their American and Niagara meters. The measuring chamber of these meters is made of the best bronze and cast and machined in halves. It rests upon a seat formed in the base, and upon opening the meter at the bolted flanges may be at once removed. It may be slightly rotated upon its seat so as to cover more or less of the outlet in the base and thus regulate the meter for unusual water pressures. The disc is made of hard rubber nearly as light as water. No reinforcements or extra parts are used to increase its weight, but the requisite strength is secured by making the central ball large, to provide ample bearing surface and by making the flat web thick. The intermediate gearing is accessible on removing the outer casing. The gears turn on long phosphor bronze pins, mounted with the driver and disc control upon a simple removable plate. Each gear is composed of a large driven gear and a small driving pinion; the pinion is fluted, pressed into the fluted hole of the gear and riveted, so they will not come apart nor the pinion turn in the gear. The tooth faces are broad and the gear circumferences large. Two kinds of indicators are in general use—the

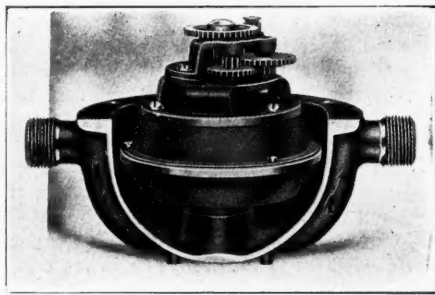
Standard, which has a continuously moving mechanism, and the straight reading, which has an intermittent mechanism. Both kinds are accurately made and positive in their action. The entire outside casing of the Niagara meter is made of a fine grade of cast iron carefully galvanized. This is the only feature that distinguishes the New Niagara from the American, as all other parts are alike.

The Gamon Meter Co., Newark, N. J., exhibited their Watch Dog meter. In this meter the area of the measuring chamber has been increased until for one cubic foot of water passed the piston makes only 235 revolutions. The measuring chamber is machined with great care and the piston disc is fitted with great accuracy, some of the clearances being only one five-hundredth of an inch. The disc has a roller thrust bearing holding it in position with the least friction. The joint formed between the pedestal in the lower casing and the disc chamber hub is an ordinary metal joint, screwed into a 3/4-inch pipe tap thread, the land around the top of the thread being about one-quarter of an inch. This small area, to be made water-tight in connection with a double bottom in the disc chamber, renders it absolutely impossible to cramp the piston at any time. To assemble or take the disc chamber out it is simply necessary to use a screwdriver as a lever and unscrew or tighten the joint. The chamber is circumferentially free from the casing, allowing a free passage for water. The strainer fits tightly over the pedestal and against the wall of the casing, having an effective area of over twenty-six times the area of the pipe, heavy particles falling by gravity to the bottom of the containing case. The gear train has all the bearings bushed with hard vulcanized rubber and has a reduction of 168 to 1. The stuffing box is internal and kept in place by the pressure by a hard rubber plug ground into a bronze bearing. The higher the pressure the tighter the joint. The flange bolts within the casing. The joint is formed have a device which distributes the pull upon four points instead of under the head of the screw only, thus avoiding springing.

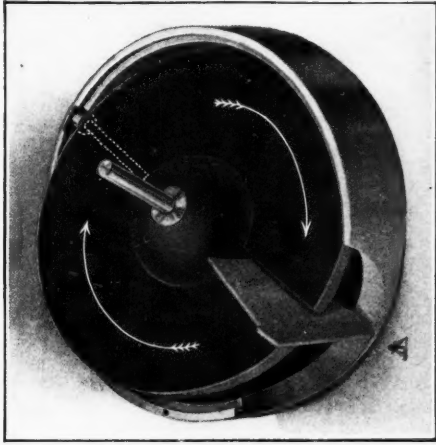
The Neptune Meter Company, New York, exhibited their Trident meter. If one characteristic feature of this old and well-known meter were to be picked out it would be the friction roller bearing which resists the circular thrust of the disc-piston. That is, in order to prevent the revolution of the disc which interferes with the regularity of the nutations, the disc is held in position by a pin located opposite the ports. This pin is provided with a roller which moves in a groove in the disc casing. By avoiding friction the accuracy of registration is increased. This roller device adds to the



BADGER



GAMON

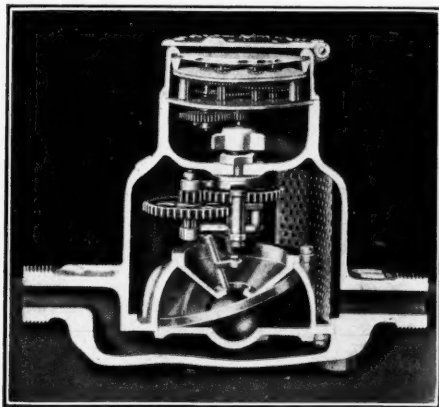


DISC OF TRIDENT

life of the disc-piston, which, in the Trident, is said never to break. The gear train consists of heavy bronze castings accurately machined. The driving pinion spindle revolves in a long hard-rubber bushing. The meter is provided with a device which prevents damage from freezing; a light casting cheaply replaced breaks and relieves the pressure.

The Pittsburg Meter Company, East Pittsburg, Pa., exhibited the Keystone disc meter. The illustration shows the D. C. type, which is now made with all bronze outer cases. Formerly these meters were made with galvanized iron upper cases. In other respects the meters are the same and all parts interchangeable. The intermediate gear construction is considered by this company as the most vital part of the meter. In the Keystone the shafts are held in accurately-made journals, while the weight of each element is carried by the sharp pivot resting on the step surface, with only a point contact. The first pinion and wheel of the train have a larger pitch and also a greater face than the second and third wheels, in order to take up the increased wear due to the higher speed at which the first wheel operates. The measuring chamber is supported in the lower case by lugs, and is held in position, without the aid of screws or bolts, by the upper case bearing on a shoulder cut in these lugs. When the upper section is removed, the measuring chamber can be immediately taken out without any annoyance of removing screws, etc.

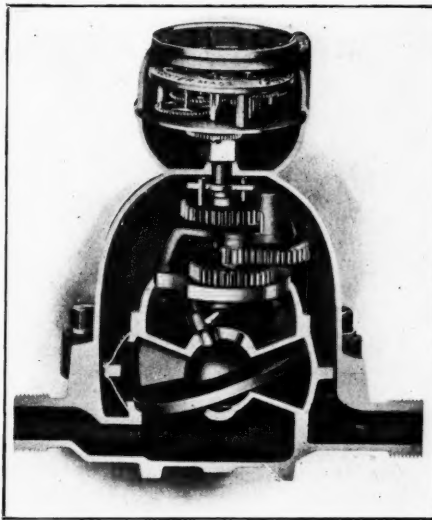
The Standard Water Meter Company exhibited a disc meter; but as their leader is a current meter of rather remarkable construction which adapts it for small services such as are usually provided with disc meters, no description is given of their disc meter.



HERSEY

The Thompson Meter Company, Brooklyn, N. Y., exhibited their Lambert disc meter. The phantom view herewith reproduced gives an excellent idea of the construction. The measuring chamber of the Lambert is large, tending to reduce friction and wear. The internal gear train consists of four gears and four pinions. The gears and pinions are made with very heavy teeth cut by special machinery, all wheels being 5/16 of an inch thick at the toothed portion or periphery, cast of semi-hard bronze composition. The four pinions are made of hardest grade phosphor bronze. The central axis or pivots of the gear are made of hardest wire-drawn phosphor bronze journaled freely at both ends in composition bearings of from 5/16 to 7/16 of an inch deep.

The Union Water Meter Company, Worcester, Mass., exhibited their King disc meter. In this meter all internal moving parts are assembled in a single working unit, readily accessible for inspection without removing the meter from the service pipe. The bearings of moving parts are of generous proportions and are protected from the entrance of abrasive material. The measuring chamber is large. Inlet and outlet spuds are low, thus allowing water to drain from



KEYSTONE

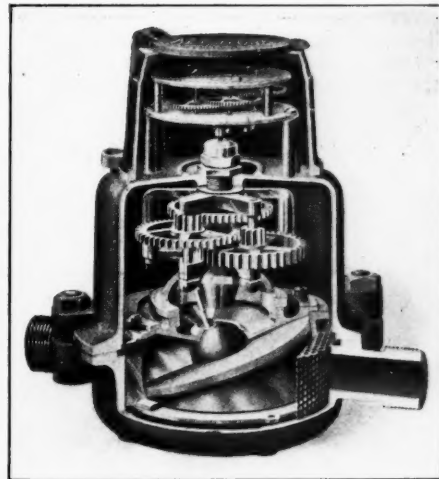
the meter to a point where damage from freezing is impossible. The spuds being a part of the lower section of the casing it is not necessary to disturb pipe connections in opening the meter for examination. The manufacturers of this meter contend that the breaking of meter discs is generally caused by unequal pressures within the chamber resulting from improper proportioning of ports. They argue that the disc of the King, unhampered by the added weight of reinforcements, has the lightness and activity necessary to respond to small flows of water, while under large draughts it is not subject to damaging stresses set up by its own action. The disc control is effected by a single hard-rubber roll mounted on the disc spindle, coacting with a stationary cone. The gear train, composed of accurate, machine-cut hard-rubber gears and bronze pinions, presents antifriction and long-wearing qualities. As hard rubber is of nearly the same specific gravity as water the weight of the gears is inappreciable. A modification of the ordinary meter is the King vertical, which is made to be set in a vertical pipe. This makes the plumber's bill for setting low and it is easy to read the index. By a simple arrangement of water passages the inlet



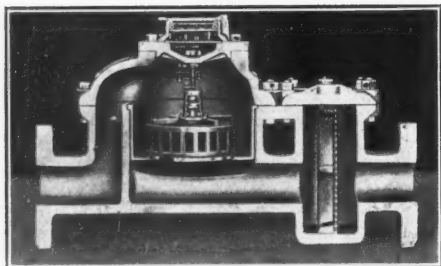
LAMBERT

and outlet connections of the King are brought into vertical alignment, while the mechanism remains in its normal position. A vertical setting is thus obtained without sacrificing either sensibility or durability. The only point of difference between this meter and the regular horizontal model is in the lower section of the casing, and an interchange of the two styles may be easily made.

Henry R. Worthington, New York, exhibited the Worthington disc meter. One feature of this meter is an opening in the bottom casting, under the ball bearing of the disc, which provides egress to the settling basin in the bottom for any fine silt or sand carried by the water. The top outside casing is made of galvanized iron or brass. The bottom casting of the smaller sizes, carrying the inlet and outlet spuds, are usually made of composition, and the main body or bottom castings of the larger sizes of iron, galvanized. In all sizes the pipe openings are on the lower casting. The company makes a specialty of furnishing meters of special composition to resist the chemical action of waters carrying elements which attack ordinary brass compositions containing zinc. The intermediate train of gearing is securely anchored upon the disc chamber. The first spindle which carries the driving pawl has a long bearing in the bottom plate and also in the top plate. Both of these bearings have bushings made of fine quality of rubber. This spindle carries a large, heavy, hard



KING



HERSEY CURRENT

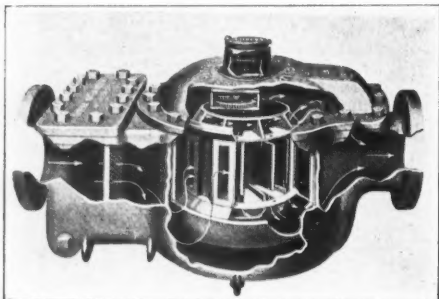
phosphor bronze pinion, which engages with the first gear. This first gear, being the fastest running, is made with an extra wide face. The gear has the No. 2 pinion pressed in and the spindle is then pressed in the pinion, making the three parts as one. Gear No. 2 has the same long bearings in the top and bottom plates. No. 3 gear is rubber bushed and is journaled on a boss on the top of the upper plate. Openings in the web of this gear permit of the entrance of the prongs of the intermediate pawl.

Current Meters.—Current Meters are variously described as current, velocity or inferential type. In this class the volume of water passing is inferentially ascertained by recording the number of revolutions of a reaction wheel or propeller which is arranged to be revolved by flowing water at a speed proportional to the velocity of the flow. Current meters are generally used for measuring large volumes of water.

The only new meter exhibited which has not actually been placed on the market is a current meter made by the Gamon Meter Company, Newark, N. J. This meter has a single set of propellers in the place of the two sets usually employed. A complete description of this meter will be given in the MUNICIPAL JOURNAL at some later date.

The Hersey Manufacturing Co., South Boston, Mass., exhibited their Torrent meter. In this meter the piston is the only moving part in the measuring chamber and is in the form of a horizontal wheel with curved vanes made of vulcanized rubber. The measuring chamber in which the wheel revolves is of bronze composition with phosphor bronze spindle and vulcanized rubber renewable bearings and bronze screws. The intermediate train which communicates the motion of the piston to the register is made of bronze throughout, with phosphor bronze spindles and screws and vulcanized rubber bearings. All working parts are held in a substantial outer case from which they are easily removable. All sizes are provided with strainers or fish traps forming part of the external case which are accessible for cleaning without disturbing the working parts of the meter.

The Neptune Meter Company, New York City, exhibited their Trident-Crest water meter. The essential features of

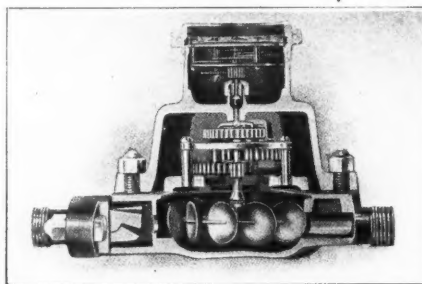


EUREKA CURRENT

the Trident-Crest water meter are the vertical position of the axis, and the mounting thereon of two propellers having helical blades formed on their edges—one a right hand spiral and the other a left hand spiral—which cause the inflowing stream to divide and flow to both the propellers in equal volume and at equal velocities. After the two streams have passed through the spaces formed by the helical blades, causing the propellers to revolve, they meet in equal volume and at equal velocity, head on, react upon themselves, radiate in all directions, and pass out at a right angle to the line of impact, through the ports of the circumferential casing to the large receiving chamber of the main casing, and thence on to the outlet spud.

The Trident-Compound meter, shown in the illustration, is a combination of a 6-inch current meter and a small disc meter. Small volumes of water go through the disc meter. Larger volumes raise a valve, shutting the disc meter out of circuit and passing all the water through the current meter.

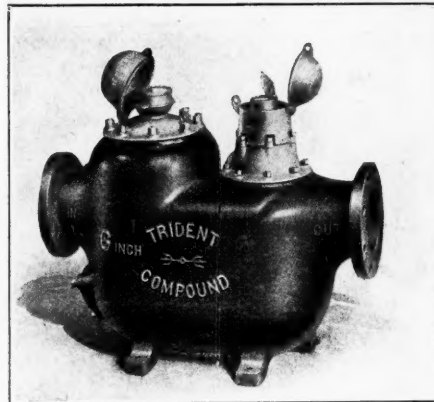
The Pittsburg Meter Company, East Pittsburg, Pa., exhibited their Eureka meter. The sectional view here reproduced shows by means of arrows the route taken by the water. The inflowing stream first passes through a strainer placed at the inlet end of the lower outer casing, is then conducted to the compartment surrounding the measuring chamber through ports located diametric-



SAPPHIRE

ally opposite each other, and enters the measuring chamber through tangential ports equally spaced around the walls of the chamber. The contact of the water upon the vanes of the wheel made of hard rubber rotates it in a horizontal plane at a speed which is proportional to the velocity of the water. A suitable crank on the top of the piston communicates the motion of the piston to the intermediate train, which in turn transmits it through a stuffing box to the registering device located on top of the meter. After its contact with the vanes of the wing wheel or piston, the inflowing water is equally divided into streams which pass out of the measuring chamber through the outlet ports in its top and bottom plates, to a common outlet in the lower outer casing. The intermediate train of gears is of the same stepped-bearing construction already described in the Keystone meter.

The Standard Water Co., New York City, exhibited their Sapphire meter. Although this is a current meter, it is made in small sizes and competes with disc meters for house services. The general outlines of the small size Sapphire are similar to those of an ordinary disc meter. In the place of the disc, however, is a device consisting of a series of cups, a cup plate and a spindle which rests on a jewel bearing. The plate and cups revolve in a casing. The water as it enters the meter from the port impinges against

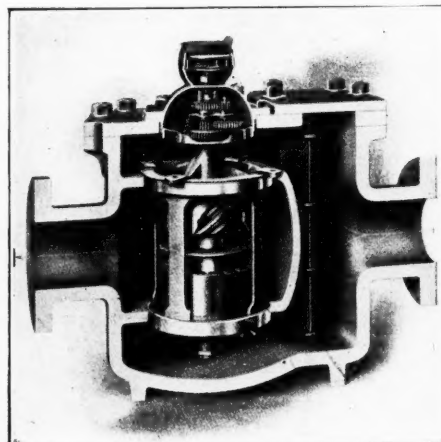


TRIDENT COMPOUND

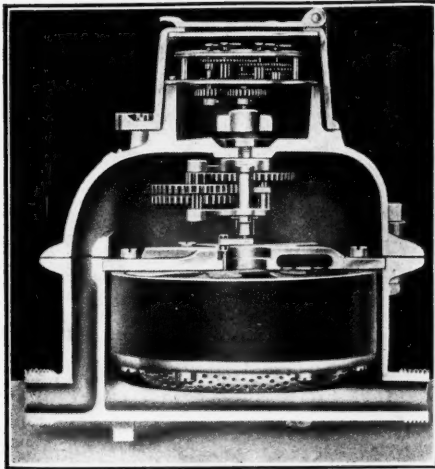
the cups and starts them in rotation, the motion being transmitted and recorded in the usual way. In order to make the meter sensitive even to very small currents there is a lip at the inlet port of the meter which drops when not in use and closes the inlet. Even so slight a hydraulic pressure as a quarter of a pound six inches head, lifts it. The effect of this device is to confine a small inflowing current to a definite area so that as it strikes the discs they will revolve. Hot water flowing back from a boiler will not injure this device as it will a rubber disc. The bodies of these meters up to and including 3-inch size are made of bronze.

The Union Water Meter Company, Worcester, Mass., exhibited their Nilo meter. This meter has a hard-rubber piston, in two sections, the upper having right and lower left hand helical vanes, the two halves being separated by a deflector plate insuring discharge of equal volumes of water from upper and lower halves of piston. The vanes are encased in a rubber shell. Interior of piston is chambered in which is placed a buoyant material which relieves weight of bronze shaft and pistons on step bearing. As vanes of piston are inclosed by the integrally revolving shells no water can pass through meter without actually passing through piston. Intermediate gearing has bronze pinions and spur gears of a specially compounded non-corrosive material, very nearly as light as water, hard, durable and fully guaranteed. Gearing is protected from possible accumulation of rust by the bronze dome, on which rests register and case. Inlet chamber of meter is provided with a screen of the bar type.

Henry R. Worthington exhibited the Worthington Turbine meter, which is a development of the turbine pump. The water enters the casing through a side



NILO CURRENT



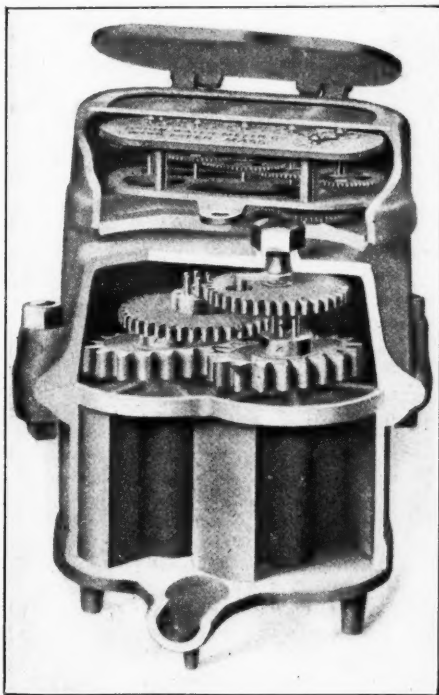
HERSEY DISPLACEMENT

strainer; the column then divides, flowing to both sides of a double wheel. The wheel is surrounded by a chamber of the volute pattern.

Displacement Meters.—Displacement meters are rotary meters which measure the water in compartments in a piston revolving in a measuring chamber.

The Hersey Mfg. Co., South Boston, Mass., exhibited their rotary meter, which is a positive displacement meter. The piston is the only moving part in the measuring chamber and is in the form of a six-toothed gear, made of vulcanized rubber. The measuring chamber is made of vulcanized rubber and bronze composition. The intermediate train is made of bronze throughout, with phosphor bronze spindles and screws and vulcanized rubber bearings. These meters are made in sizes from $\frac{5}{8}$ to 2 inches.

The Union Water Meter Company, Worcester, Mass., exhibited their rotary piston meter, varying in size from $\frac{5}{8}$ to 12 inches. The meter derives its name from its fundamental principle: the rotation of two pistons on vertical axes. These pistons, mutually controlled in their respective chambers by means of elliptical gears, constitute the entire meas-



UNION WATER CO.

uring mechanism of the meter. A simple gear train transmits their motion to the register. The construction of the rotary meter allows practically uninterrupted flow of water, and the action of the pistons being continuous and positive, accurate measurement with a minimum of retardation is insured. No wear takes place in the measuring chambers, consequently they retain their original dimensions, and the accuracy of the meter remains unimpaired during long periods of service.

Water Meter Attachment and Protector

The H. B. Van Order Attachment and Water Meter Protector Co., Ithaca, New York, exhibited a number of rubber disks taken from water meters that had been distorted by the action of hot water. This is an accident which may occur particularly when the meter is located close to a boiler either in a power plant or even in a residence when the boiler becomes overheated. The protector not only prevents hot water from entering the meter but prevents anyone from reversing the meter and thus virtually stealing water. The illustration shows the attachment separately and as attached to a meter—in this case a Trident. There are three check valves, one on each side of the meter between it and the meter and the other in the middle of the bypass. The check valve on the boiler side of the meter prevents water from returning through the meter. The check in the bypass will allow back flow of water if the pressure is sufficient. If the meter is reversed the check normally on the side towards the main prevents water from passing through to the consumers' fixtures.

Exhibits at American Water Works Association Convention

ALLYNE BRASS FOUNDRY Co., Detroit, Mich.—Corcoran lead pipe couplings.

AMERICAN ASPHALTUM & RUBBER Co., Chicago, Ill.—Samples of asphaltum, showing its remarkable flexibility and rubber-like qualities. Photographs and printed matter showing waterproofed reservoirs and methods of construction. Pipe dip.

BADGER METER MFG. Co.—Water meters. L. M. BOOTH Co., Chicago, Ill.—Photographs and literature explaining the Booth water softener.

JAMES BOYD & BRO., Inc., Philadelphia, Pa.—Rotary valve seats.

BUILDERS IRON FOUNDRY, Providence, R. I.—Venturi tubes and meters. Model installation for measuring boiler feed water.

BUFFALO METER Co., Buffalo, N. Y.—Water meters.

CENTRAL FOUNDRY Co., New York, N. Y.—Universal pipe, a cast-iron pipe made in short lengths with machined joints.

H. W. CLARK Co., Mattoon, Ill.—Meter boxes.

COLUMBIAN IRON WORKS, Chattanooga, Tenn.—Meter boxes, valve boxes.

EAST JERSEY PIPE Co., New York, N. Y.—Section of bar lock pipe.

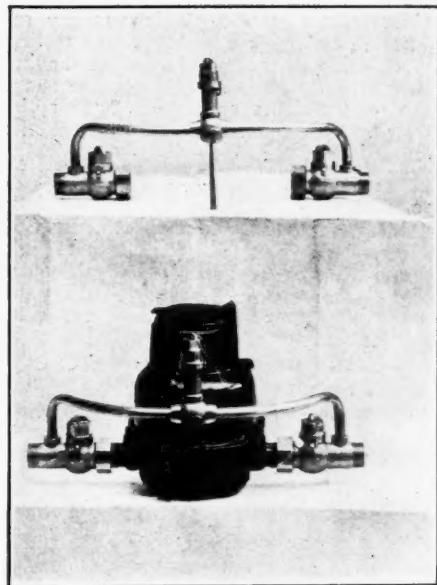
EASTERN MFG. Co., Elmira, N. Y.—Samples of wood stave pipe, sections showing method of construction.

FAIRBANKS Co., New York, N. Y.—Fire hydrants.

FORD METER BOX Co., Wabash, Ind.—Sectional view of meter box.

GAMON METER Co., Newark, N. J.—Water meters.

GLAUBER BRASS MFG. Co., Cleveland, O.—Goosenecks, brass stop cocks, corporation cocks, etc.



WATER METER PROTECTOR

GOULDS MFG. Co., Seneca Falls, N. Y.—Two single-stage centrifugal pumps.

HAYS MFG. Co., Erie, Pa.—Payne's patent tapping machines, Hays Fire extension service boxes.

HERSEY MFG. Co., South Boston, Mass.—Water meters.

INTERNATIONAL STEAM PUMP Co.—Water meters.

INTERNATIONAL SEAL & KNOT PROTECTOR Co., New York, N. Y.—Device for sealing meters with a wire and seal to prevent tampering with the dials.

JENKINS BROS., New York, N. Y.—Valves, automatic, equalizing, stop and check valves.

KENNEDY VALVE MFG. Co., Elmira, N. Y.—Gate valves.

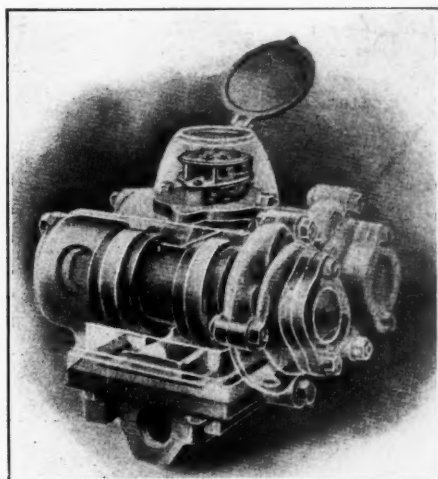
LEADITE Co., Philadelphia, Pa.—Composition for jointing cast-iron pipes.

LEAD LINED IRON PIPE Co., Wakefield, Mass.—Sections of lead lined pipe, special fittings, couplings, etc.

L. J. LOWE, Clarksville, Tenn.—Lowe automatic self-locking meter box.

MODERN IRON WORKS, Quincy, Ill.—Snow quick repair stop box cover, wireless pipe locator.

H. MUELLER MFG. Co., Decatur, Ill.—Three sizes of tapping machines, water meter testing machines, portable lead furnace, valve box, brass fittings, kit of tools, Mueller's sprinkler and flushing hydrant for obtaining water for flushing streets. The box is level with the surface of sidewalk or pavement, presenting no unsightly



WORTHINGTON

obstruction to traffic. This company reports great interest in its meter testing machine, two orders for them having been actually placed. The machine has a device by which very large meters may be tested. All water passing through the meter is actually weighed.

MUNICIPAL JOURNAL, New York, N. Y.—Magazines.

NATIONAL WATER MAIN CLEANING CO., New York—Sample of incrustated pipe. Physical objects removed from pipes. The company gave a demonstration of water main cleaning at a convenient point during the convention.

NEPTUNE METER CO., New York, N. Y.—Water meters.

NEW YORK CONTINENTAL JEWELL FILTRATION CO., New York, N. Y.—Photographs and literature describing different types of rapid mechanical filters and machinery for the chlorination of water.

PENNSYLVANIA SALT MFG. CO., Philadelphia, Pa.—Sample of chloride of lime. Drums in which chemicals are shipped.

PITOMETER CO., New York, N. Y.—Model pitometer installation for recording flow of water in mains. New prism attachment increasing accuracy of readings. Literature explaining operation and results.

PITTSBURG FILTER MFG. CO., Pittsburg, Pa.—Photographs and literature.

PITTSBURG METER CO., East Pittsburg, Pa.—Water meters.

RENSSELAER MFG. CO., Troy, N. Y.—Corey solid stream frostproof fire hydrant, with casing cut away to show working parts. The valve is in the horizontal pipe leading to the hydrant and is controlled by a toggle joint. Rensselaer gate valves.

ROSS VALVE CO., Oakwood avenue, Troy, N. Y.—Regulating valves for steam, water and air. Large valves for street mains. Ross water engine.

A. P. SMITH, MFG. CO., Newark, N. J.—Gate valves, tapping apparatus, hydrants, water meter testing machine.

G. H. SNELL, Attleboro, Mass.—Easy-on pipe couplings and tees.

SIMPLEX VALVE & METER CO., Philadelphia, Pa.—Water measuring devices.

STANDARD ASPHALT & RUBBER CO.—Sample of asphalt showing rubber-like consistency. Samples of waterproofing materials. Photographs and literature showing waterproofing of reservoirs. Pamphlet describing the 72-inch steel pipe line of the Brooklyn water supply lined with Sarco pipe dip. Pamphlet showing waterproofing of bridges.

STANDARD WATER METER CO., New York, N. Y.—Water meters.

THOMPSON METER CO., Brooklyn, N. Y.—Water meters.

UNION WATER METER CO., Worcester, Mass.—Water meters.

H. B. VAN ORDER WATER METER ATTACHMENT & PROTECTOR CO., Ithaca, N. Y.—Device for protecting meters from damage by back flow of hot water.

WATER WORKS EQUIPMENT CO., New York, N. Y.—Tapping machines, tapping sleeve and valve, corporation stop cocks, stop and waste and inverted key cocks, extension service boxes, emergency sleeves, Star pipe jointer, pipe cutters, gasoline lead furnace. The company gave a demonstration of its portable contractors' gasoline pumping outfit at a convenient point near the hotel. The members of the association who witnessed the test were favorably impressed with the capacity and portability of the machine.

A. WYKOFF & SONS CO., Elmira, N. Y.—Wykoff patent steam pipe covering. This pipe consists of layers of tin, asbestos, wood, corrugated paper, wood and asphaltum covering.

MUNICIPAL APPLIANCES

Vertical Thrust Multiple Stage Deep Well Pump

The accompanying illustration shows an installation of four Hill-Tripp vertical thrust, multiple stage deep well pumps at Chicago Heights, Ill., made by the Hill-Tripp Pump Company, Anderson, Ind. The installation is interesting because it is claimed that a world's record for deep well pumping was established here. The inside diameter of the well casing was 12 inches, the lift was 72 feet and the gallons pumped per minute was 2,780.

The action of the Hill-Tripp pump is similar to that of the propeller of a boat except that the water is moved forward instead of the propeller, and, with this

have no bosses, set screws, balance weights or obstructions on the inside. They are placed from three to four feet apart on shaft sections of nine and ten feet. Thus, if ten-foot sections are used, and the shaft is dropped 60 feet in the well there would be 18 impellers along the shaft. Deflectors are placed at proper intervals to retard the whirling of the water. Bands surrounding each impeller are held in place by connections that allow the largest possible diameter of impeller. A slight water space is left between band and impeller to prevent metal contact. No other bearings are required down in the well, all being hung from the head above. The speed of revolution varies for different conditions and sizes from 800 to



DEEP-WELL PUMPING PLANT, CHICAGO HEIGHTS, ILL.

device, in an upward course. A system of impellers are located at proper intervals along a vertical shaft extending down in the well to the proper depth. This shaft, with impellers, being revolved rapidly by means of a drive head at top of well with proper ball or roller thrust and lateral bearings to insure the minimum of friction wear and power. These drive heads are built for either vertical or horizontal belt drive or for direct attachment of electric motor, steam turbine or engine. In the Chicago Heights plant the vertical head drive with electric motor attached was used. The motor is provided with a thrust bearing to carry the weight of armature while head is fitted with ball thrust bearing to carry the weight of impellers, shaft and water. An improved oiling device is provided to keep the bearings submerged. The head is self-contained and heavy enough to absorb vibration and torsional strain. The sections of shaftings are connected with bronze screw couplings, the shaft revolving in the direction that draws them tight. Impellers can be made of iron or bronze, according to the nature of the water pumped. They are turned true and made of the proper pitch to insure the best lifting capacity and run in rings or bands of suitable dimensions arranged so as to utilize the largest diameter possible in the well, no moving parts coming in contact with the well casing. All parts in the well can be put in or taken out from the top of the ground through the base plate, and no pit or open shaft is needed. The impellers are turned true on the outer surface and

1,600 revolutions per minute. For a 12-inch well the head weighs 3,000 lbs., speed is from 800 to 1,000 revolutions per minute, rated capacity from 1,000 to 1,500 gallons for lifts of from 25 to 150 feet, and the horsepower required from 25 to 150.

Pipe Lowering Appliance

A handy device for lowering sewer pipe in a trench and aiding in the jointing process is made by John Yates & Company, Limited, Aston, Birmingham, England. It is generally used in connection with a small derrick, and is claimed to result in the saving of the labor of one man, besides decreasing the ordinary loss from the heating of pipes. The device is simply a band of iron, bent to an acute angle, and a clamp attached to a chain. The chain and one end of the iron band are attached to a ring, to which the line from the derrick is attached.



GRAPPLE FOR LOWERING PIPE

NEWS OF THE SOCIETIES

American Water Works Association.

—The annual meeting of one of the largest American societies whose field is a branch of municipal work gives rise to the query, "What is the function of the society and what was the meeting for?" Other societies, many of them, exist in this and other countries whose membership is made up of men engaged in municipal and engineering work. There is a difference, however, between American societies and those of foreign countries. This arises from the differences in administration of government. In England the Board of Trade exercises some supervision over city affairs. In Germany government control of city affairs is much greater than in England. In both cases, and in other countries, cities are kept in touch with each other by the publication of statistics, data for which the government has ample power to obtain, and by the control of expenditures, at least those requiring bond issues. In America in recent years cities are to some extent kept in touch with each other by a more or less efficient Census Bureau, a bureau hampered in its work for lack of authority. A few states in recent years, through accounting departments, have attempted to supply the deficiency which, it is generally felt, exists.

As having a bearing on this question, it is worth noting that many of our prominent educators, college professors and others who are looked on as leaders of thought return from trips to Europe, or the periods spent there as exchange professors, imbued with the idea that a strong central government, one that, among other duties, should exercise more control over city governments, is the great desideratum for this country. If they would study what is going on among municipal societies they would see how the need for closer association of municipalities is being efficiently supplied by technical societies, such as the American Water Works Association. At the Rochester convention delegates from all over the country, from Washington to Florida, and from Maine to Texas, met and discussed, under a guarantee of absolute freedom of speech, the most important problems regarding which there are differences of opinion, or any other problem regarding a detail, however small, which any member chose to bring up. The thrashing over of these questions in such an assembly may develop in our water works department a degree of efficiency which even the power of a strong central government could not bring about, for there are dangers in bureaucracy, and authority is prone to suppress initiative.

That many of the delegates at the convention were conscious of the semi-governmental character of the society was apparent in the course of a discussion of the relations between water works departments, insurance companies and the city. Some members favored government supervision over these relations. But the question of freedom of speech in the society was promptly defended when a motion was made which was in effect in part a criticism of a fellow member who called in question the fairness of insurance interests in dealing with municipalities regarding the supply of water for fire protection. On the whole, it would seem as if the American system of initiative in management

would be promoted by the growth in influence of such associations as the American Water Works. It is to be hoped that, though the Rochester meeting was the most largely attended ever held, that the 1912 convention, at Louisville, Ky., will be still larger.

The thirty-first annual convention was formally opened in the banquet room of the Powers Hotel, Rochester, N. Y., Tuesday, June 6, by President John W. Alvord, Chicago, Ill. Mayor Edgerton welcomed the association, reminding it that Rochester took pardonable pride in its water works system, both as to the quality of its water and the equipment that delivers the unfailing supply. President Alvord replied. Secretary-Treasurer John M. Diven, Charleston, S. C., read his report, indicating that the society is in a flourishing condition, financially and in point of membership, substantial gains having been made during the past year. President Alvord, in his annual address, touched on many phases of the general subject of intimate interest to his audience.

At the afternoon session considerable time was given to receiving various committee reports. The reports from the Committee on Electrolysis, which was presented by Chairman D. H. Maury, consulting engineer, Peoria, Ill., was of much interest, dealing as it did with one of the vexed problems of maintenance of water mains.

Theodore A. Leisen, of Louisville, Ky., chairman of the special Committee on a National Bureau or Department of Health, presented the report of that body. Considerable significance is attached to the work of the committee by reason of the possibility that Congress will create such a bureau. The committee was appointed at the association meeting a year ago to stimulate in so far as practicable such action by Congress. No active effort will be made at the present special session, but it is planned to prosecute the plan with the opening of the regular session.

Two papers were presented at the afternoon session. Thomas McMillan, of Milwaukee, discussed at considerable length "Pumping Station Management." Illustrations were drawn from the experience which Mr. McMillan had gained in his home city.

George Houston, of Kalamazoo, Mich., presented the live topic, "Fire Line Meters, a Comparison of Efficiency." The subject is in a way chronic, coming up as it does periodically for consideration. On one side are arrayed the interests representative of waterworks systems in general, who, with much show of reason, hold that all water should be metered in order to provide a reliable check against abuse.

In as formidable a line-up are the insurance interests, which insist that installation of meters in lines designed to give special fire protection through sprinkling systems and other apparatus in large industrial plants impedes the force of water, reducing the efficiency of the apparatus. The insurance men conclude that reduced protection should find its equivalent in higher insurance rates. That there is much to be said on each side was indicated by Mr. Houston's paper and the discussion that it aroused.

With the close of the afternoon session at 5 o'clock the men of the association were the guests of the Bartholomay Brewing Company for two hours.

At the evening session Leonard Metcalf, of Boston, presented a paper on subject, "Some Fundamental Considerations in the Determination of a Reasonable Return for Public Hydrant Service," which had been prepared collaboratively by Mr. Metcalf, Emil Kuickling and W. C. Harvey. The discussion was illustrated with lantern slide charts. D. H. Maury, of Peoria, Ill., gave an illustrated lecture on the Panama canal.

During the progress of the evening session the women of the convention were entertained at cards in one of the hotel parlors.

The session of Wednesday forenoon was taken up with discussion of the previous day's papers, particularly that of Leonard Metcalf, on reasonable returns for public hydrant service. The relations between the city, the water works department and fire insurance companies were discussed by many members in the light of their own experience. General dissatisfaction seemed to exist with the insurance companies for alleged failures to make reductions in rates that were expected in return for water works improvements. However, it was admitted that little was known about insurance affairs and profits, and it was admitted that insurance losses had been very large in recent years. The case of Newark, N. J., was cited, where a high-pressure fire pipe line had been established with a view to reduced rates. When the work was completed insurance rates generally were raised, and those in the newly protected district reduced from the new rate to just what they were before.

The election of officers and selection of the city for the next convention followed. The following officers were elected: Alexander Milne, president; Dow R. Gwinn, first vice-president; Robert J. Thomas, second vice-president; John A. Affleck, third vice-president; John M. Diven, secretary-treasurer. Finance Committee—H. E. Keeler, chairman; Leonard Metcalf and Charles R. Henderson, Executive Committee—Alexander Milne, Dow R. Gwinn, H. E. Keeler, Leonard Metcalf, Robert J. Thomas, John A. Affleck, George G. Earl, Charles R. Henderson, John M. Diven, Theodore Leisner and John W. Alvord.

Louisville, Ky., was chosen for the meeting place for 1912 by a large majority, with Minneapolis second.

The afternoon session was given to the reading of papers, that of J. Chalkley Hatton, Wilmington, Del., on Wood Stave Pipe, answering a number of questions in the question box. The author took a very favorable view of the adaptability of wood stave pipe for water mains in matters of economy in construction, durability and serviceability in the matter of conveying water without serious leakage. He was asked whether the pipe would not rot at high places in the lines and replied that air valves installed at such points would, in his opinion, overcome the difficulty.

In the evening the members were the guests of the Water Works Manufacturers Association who had charge of the exhibit of water works appliances in the corridors of the hotel. Special trolley cars were in waiting near the hotel. On the way a stop was made at the pumping station of the Rochester & Lake Ontario Water Company. The final stop was made at Manitou Beach, where a fish dinner was served. After dinner the party was taken to Ontario Beach Park,

which is the popular resort of Rochester.

Thursday sessions were given to the reading of papers. George G. Earl, New Orleans, explained the system of metering all water services that had been adopted in connection with the inauguration of the new water rates. He explained the basis of rates was arrived at with the end in view of charging all persons alike for water consumed. Charles A. Hague explained the uses of compressed air in water works construction. Papers by Alexander Milne and W. A. McFarland were read by title. A paper by George C. Whipple on hot water problems, which is abstracted at length on another page was presented. C. C. Brown read a paper on the keeping of water works records. Two papers were read which had a bearing on the same general subject, the purification of water. Dr. J. L. Leal explained the theory and practice of the disinfection of water by the use of hypochlorite of lime, and gave instances of its use where typhoid fever epidemics had been stopped. D. D. Jackson presented a paper explaining the physical, chemical, bacteriological and microscopical methods of examining water. Lantern slides were exhibited showing some of the larger organisms existing in water easily removable by mechanical means and bacteria and amocbae visible under the high powers of the microscope. He mentioned those that were and those that were not killed by weak solutions of hypochlorite of lime.

In the evening the city of Rochester provided an entertainment for the members. The largest band in the world gave a concert in the Park Area, and special trolley cars were provided for taking the guests to and from the park.

The Friday forenoon session was given to the reading of papers. In the afternoon, by invitation of the Water Works Manufacturers' Association, the members attended a matinee in Lyceum Theater.

National Association of Comptrollers and Accounting Officers.—The convention was called to order at the Arlington Hotel, June 9, by Alonzo Tweedale, auditor of the District of Columbia, who is president of the association. An address of welcome was made by H. B. F. MacFarland, former Commissioner of the District of Columbia.

The proposition of Herman A. Metz, former controller of the city of New York, to provide a fund of \$10,000 a year, for three years, "to make available to American municipalities the best principles and practice worked out in municipal accounting and reporting," was announced by President Tweedale in his address to the convention. Mr. Metz had written to Mr. Tweedale on the subject.

"Mr. Metz clearly shows in his letter," said Mr. Tweedale, "the great desirability of uniformity in accounting methods throughout the larger cities of the United States, and in a practical way makes possible the accomplishment of that work in which he has been so vitally interested. In my reply I stated to Mr. Metz that in my opinion no other action that had been taken up to that time would be of such great and lasting benefit, and that the result of his endeavor carried to completion would be the saving of millions of dollars annually to the taxpayers in the United States.

"I cannot close without inviting at-

tention to a severe loss suffered by the association during the last year. I refer to the death of our fellow-worker, Frederick W. Carey, city auditor and assessor of Sacramento, Cal., a man whom we all knew and learned to love."

Representative Otto Lobeck, who was elected to the present Congress while controller of the city of Omaha, Neb., and a member of the association, made a brief speech, in which he greeted his former associates, wishing that all of them were in Congress to inculcate principles of proper accounting into the national government's methods. He referred to municipalities as the greatest and most powerful corporations on earth.

The following officers were elected: Edmund D. Fisher, deputy controller of New York City, president; Vice-presidents, S. M. Wilhite, Louisville, Ky.; E. Stetson Griffing, New Rochelle, N. Y.; A. B. Frost, Chelsea, Mass.; A. M. Heston, Atlantic City; J. S. Culpepper, Norfolk, Va.; Dan C. Smith, Jr., Houston, Tex.; J. J. Crowder, Peoria, Ill.; W. H. Farnham, St. Paul, Minn.; L. D. Everts, Milwaukee, Wis.; A. B. Pfouts, Denver, Col.; E. E. Phelps, Pittsburg; W. H. Deharity, Indianapolis, and Dr. Le Grand Powers of the census bureau; secretary, George M. Rex, Providence, R. I.; treasurer, W. S. McCormick, Duluth, Minn. At the second day's session Buffalo was chosen for the 1912 convention.

Aside from the addresses the feature of the meeting was the adoption of a resolution offered by Milton R. Palmer, deputy controller of Detroit, condemning a policy of some newspapers which give percentage of money to officials furnishing city advertising.

Saturday E. D. Fisher delivered the opening address and he chose as his topic "Standardization" and told how the board of estimate and apportionment of New York City by the appointment of a commission has been able to economize and save the city thousands of dollars.

Dr. Le Grand Powers, chief statistician of the census bureau, made an address at the banquet at the Arlington. He urged state supervision of city accounts, saying that such supervision would tend to make more uniform the systems of accounting in American cities.

The statistician also declared that public accounting is as a rule superior to methods in vogue among private institutions.

Another address that attracted attention was then made by Edmund D. Fisher, deputy controller of New York City, who told of a new system of borrowing for his city. In order not to flood the bond market, New York City will in the future sell most of its bonds in Europe.

Duncan MacInnes, of New York, W. S. McCormick, of Duluth, Minn.; Representative C. O. Lobeck, of Omaha, Neb., a former president of the association, and Alonzo Tweedale, auditor of the District of Columbia, made brief addresses.

In the afternoon President Taft greeted the delegates. The reception took place in the east room of the White House, and before shaking each visitor by the hand Mr. Taft made a brief speech praising the character of the management of public moneys by men in the employ of the federal and state governments. Alonzo Tweedale introduced each delegate to the Presi-

dent and briefly responded to the chief executive's remarks.

The feature of the morning's session of the convention at the Arlington was an extended dissertation by Dr. Frederick A. Cleveland on the "Financial Statements of Municipalities." Dr. Cleveland is chairman of the President's commission on economy and efficiency. The five members of this commission were present to hear the address.

Dr. Cleveland, after pointing out the good and bad points in accounting systems in various cities, made special reference to the balance sheet contained in the last annual report of the controller of Philadelphia. He used the statement as a model, and showed how the government and the public could see at a glance the exact financial condition of the city.

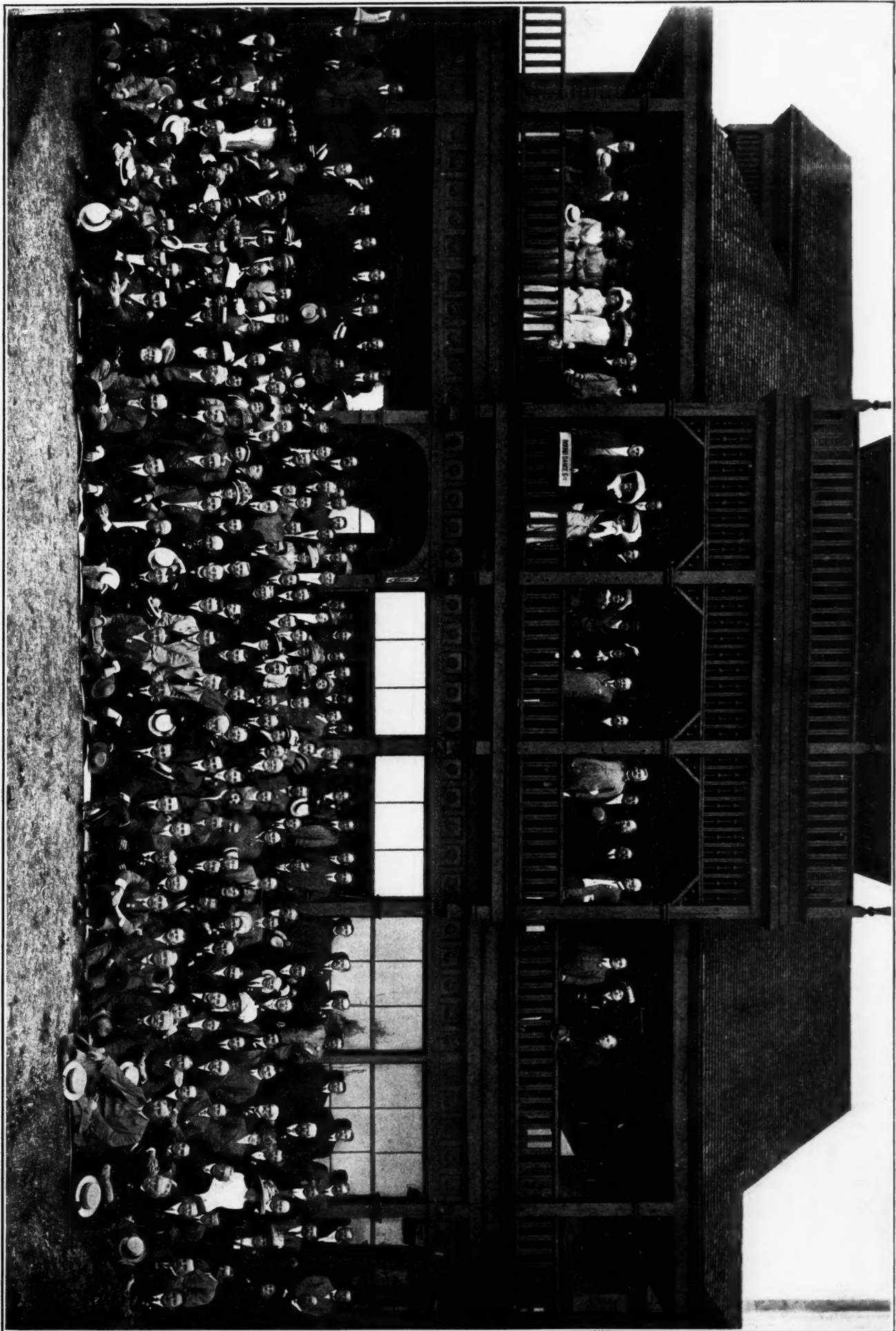
Representative Sweet, of Michigan, was the first speaker in the morning, and he was followed by Howard C. Beck, of Detroit, who took as his topic "The Capital Account of a City." He asserted that the capital account of a city should be the value of all of the property of the city in excess of its liabilities.

Representative Swager Sherley, of Kentucky, won liberal applause when he closed his address at the first day's session by urging a modern system of municipal and governmental budget making which would enable a plain citizen to gain a tangible idea of just what the expenses of the government are in comparison with expenses in other cities.

Dr. Le Grand Powers, chief statistician of the census bureau, was another speaker at the session. He declared that certain cities were issuing bonds without presenting statistics to show that proceeds of former bond issues had been disposed of in a wise manner. As an example he said: "Take the case of a city which issues bonds for a period of fifty years, and with the proceeds lays pavements which last only for eight or ten years. The same city will turn and issue more bonds with which to relay the pavement, and thus piles up debt on debt, with the probability of becoming bankrupt in the future."

Connecticut State Fire Chiefs.—The semi-annual session of the Connecticut Fire Chiefs' Club was held in Bridgeport June 5 with 25 members present. The session was called to order at 11 o'clock in the parlors of the Atlantic Hotel with former Chief A. C. Hendricks, of New Haven, presiding as president. He was given an ovation. Over 80 years old, he still takes an active interest in the work of the organization and gave some interesting reminiscences of the work. He is the first and only president the organization has had. The day marked the first time in several months that he has attended any social or business sessions.

The programme was entirely informal with no special speakers or set arrangements. The discussion was general and comprised remarks on the topic "Fire Prevention of More Importance Than Fire Extinguishment." Bridgeport's fire commissioners were the guests of the organization. Dinner was served at 2 o'clock and afterwards there was an informal inspection of Bridgeport's fire fighting facilities. During the forenoon session there was an alarm from Box 16 and the visitors were given an opportunity to note the Bridgeport apparatus in practical work.



DELEGATES AND GUESTS ATTENDING AMERICAN WATER WORKS ASSOCIATION
Photograph taken at Manitou Beach, near Rochester, N. Y., June 7, 1911.

PERSONALS

American Chemical Society.—J. W. Ellrus, superintendent of filtration, Cincinnati water works, read a paper before the Cincinnati section, May 10, on "Sewage Disposal of Cincinnati and Vicinity." He advocated the establishment of a Cincinnati sanitary district, which would include all of the immediate territory on both sides of the river, for the purpose of disposing of the sewage on scientific principles.

Louisiana Engineering Society.—J. F. Coleman, New Orleans, presented a paper, May 8, at the monthly meeting of the society on The Engineer's Problems of Land Reclamation. J. C. Haugh presided.

Albany, N. Y., City Planning Association.—The first act of the new board of governors was to direct the executive committee to prepare an ordinance for introduction in the City Council for the appointment of an expert city planner to be in the employ of the city. The association is composed of representatives of other city organizations.

Union of Canadian Municipalities.—Secretary W. D. Lighthall has announced that the eleventh annual convention will be held in the City Hall, Quebec, by invitation of Mayor Drouin, on August 29-31. The following are among the topics that will be discussed: "Town Planning and Embellishment," "Special Functions of a Provincial Capital," "Conservation of Water and Water Powers," "Country Roads," "Railway Terminals and Crossings," "Street Railway Freight Carriers," "Pure Food in Cities" and "Fire Protection."

Calendar of Meetings

- June 11-16.**
International Association of Chiefs of Police.—Eighteenth Annual Convention, Rochester, N. Y.—Major Richard Sylvester, Superintendent of Police, Washington, D. C., President.
- June 13-18.**
New York State Association of Chiefs of Police.—Annual Convention, Rochester, N. Y.
- June 13-16.**
American Society of Civil Engineers.—Annual Convention, Chattanooga, Tennessee.—Charles Warren Hunt, Secretary, 220 West 57th St., New York.
- June 21-22.**
National Conference of Poor Law Officials.—Boston, Mass.—Dr. Robert W. Hill, President State Board of Charities, 105 East Twenty-second street, New York City.
- June 22-24.**
Intermountain Good Roads Association.—Annual Convention, Pocatello, Ida.—Caleb Tanner, State Engineer.
- June 27-July 1.**
American Society for Testing Materials.—Fourteenth Annual Meeting, Hotel Traymore, Atlantic City, N. J.—Edgar Mackay, Secretary, University of Pennsylvania, Philadelphia, Pa.
- June 28-29.**
South Carolina Water Works Association.—Meeting for Organization, Columbia, S. C.—W. F. Steiglitz, Temporary Secretary, Columbia, S. C.
- June 28-30.**
International Association for the Prevention of Smoke.—Annual Convention, Newark, N. J.—R. C. Harris, Secretary, City Hall, Toronto, Ont.
- August 15-18.**
Firemen's Association of the State of New York.—Rochester, N. Y.—Thos. Honohan, Secretary, Frankfort, N. Y.
- September 12-15.**
International Association of Municipal Electricians.—Annual Convention, St. Paul, Minn.—Clarence R. George, Secretary, Houston, Tex.
- September 18-30.**
International Municipal Congress and Exposition.—Chicago, Ill.—Curb M. Treab, Secretary, Great Northern Building, Chicago, Ill.
- September 18-October 1.**
Fourth International Good Roads Congress.—Chicago, Ill.—J. A. Rountree, Secretary, Birmingham, Ala.

BIGELOW, E. M., of Pittsburg, Pa., the new State Highways Commissioner, will supervise the construction of the 7,000 miles of improved roadways provided for in the Sproul bill and will have full charge of the Governor's improved roads plan, which is one of the most comprehensive that any State ever has mapped out. J. W. Hunter, who has been at the head of the road department, probably will become Mr. Bigelow's first assistant.

BIRMINGHAM, EUGENE, has resigned as Superintendent of Police of Bridgeport, Conn.

DOCKWEILER, J. H., water expert of Oakland, Cal., has been engaged by the City Council to render an expert report on the water situation there for rate-fixing purposes. The council has been working on the question of the water rate for the past two months, and confronted by an array of facts and figures submitted by the People's Water Company, has called upon Dockweiler to analyze them for the consideration of the council.

EMMART, WM. M., chairman of the committee on city planning of the City-Wide Congress, of Baltimore, made a plea for a city beautiful as well as a city useful in an address recently before the North Carolina Society.

EPSTEIN, JACOB, is the first to accept the invitation Mayor Preston of Baltimore extended to a number of prominent business men, asking them to serve as members of his advisory commission.

FARLEY PHILIP P., President of the Jamaica Bay Improvement Commission, has been appointed Deputy Fire Commissioner of New York City. Mr. Farley was the Democratic candidate for State Engineer and Surveyor in 1908.

FORREST, C. M., an asphalt expert from Albany, spent several days in Binghamton, N. Y., recently, inspecting the various roads treated with asphaltic oil during the past two years. Mr. Forrest on his return to Albany made reports and recommendations to the State Highway Commission as the result of his investigations.

FUERTE, JAMES H., sailed from New York on May 31 for Para, Brazil, where he will make a report on the sewerage of that city. He will return to New York about the middle of July. A few years ago Mr. Fuertes was a member of the commission of engineers, including his father, the late Estevan A. Fuertes, and Dr. Rudolph Hering, which prepared plans and made a report on the sanitation of the city and port of Santos, Brazil.

GOODWIN, DR. EDWIN, the new Health Officer of Bay City, Mich., after a month of preparation, including a two weeks' post-graduate course "brushing up" on bacteriology and microscopic work at Ann Arbor at his own expense, has started in a sanitary inspection of Bay City such as the town has never before enjoyed. He expects to be busy a couple of months as he will review the sanitary conditions surrounding all meat markets, dairies and milk depots, restaurants, grocery stores, ice cream plants, slaughter houses, bakeries, candy stores and a number of places where other articles of food are made. His procedure will be novel in that he has secured the free services of several men who are experts in their various lines of business.

HAMILTON, JOSEPH W., has been appointed City Engineer of Pasco, Wash. He enters the service of the city from the United States Reclamation Service, where he has been engaged on the Sunnyside project. He is a graduate of the University of Virginia and was formerly City Engineer of St. Paul, Va.

HARPER, E. F., has been appointed City Engineer of East St. Louis, Ill. Mr. E. W. Rodenberg has been appointed Assistant Engineer in charge of outlet sewer, and Mr. James F. Parr, Assistant Engineer, in charge of streets.

HAIGHT, LESLIE, has been appointed Superintendent of Fire Alarm at Binghamton, N. Y.

HERBERT, H. W., has been chosen by the Water Commission of Camden, N. J., as chief of the Water Department to fill the unexpired term of Robert Hollingsworth, deceased.

HOWARD, DR. HARRISON W., is the new Mayor of Wilmington, Del.

HIRZEL, ALFRED J., has been appointed City Engineer of Wilmington, Del.

HUNT, A. M., has been appointed consulting engineer for the construction of the Geary Street municipal railway, of San Francisco, by the Board of Public Works. He has been engaged for a number of years past in hydro-electric power development and with public service companies in the west coast cities. He was connected with the work of conversion of the Los Angeles railways from cable to electric power.

HALL, ROBERT, who for the past ten years has held the position of manager of the Corpus Christi water supply department, has resigned the position to assume charge of the interests of F. Z. Bishop at the new city of Bishop, Texas.

JONES, WILLIS S., has been appointed City Engineer of Pomona, Cal.

MANN, G. W., remains as City Engineer of Reno, Nev., under the new administration.

MARTIN KINGSLEY, of New York, handed his resignation as Bridge Commissioner to Mayor Gaynor. He gives up the position to accept one as head of the Foundation Company, a concern whose specialty is the constructing of foundations for buildings.

MIXON, C. M., has been elected mayor of Amite City, La.

MOORER, H. B., is the new mayor of Henning, Tenn.

MOTT, FRANK K., was re-elected mayor of Oakland, Cal.

O'MEARA, STEPHEN, has been appointed Police Commissioner of Boston, Mass.

PEYTON, E. A., was reappointed Superintendent of Water and Sewers by Mayor Burton of Chickasha, Okla., Mr. Peyton has been in charge of the plant for the past six years.

RUSHLIGHT, A. G., has been elected Mayor of Portland, Ore.

SAMUEL, GEORGE F., has been appointed Engineer of Track Elevation for the city of Chicago. He has been engaged in municipal work since his graduation from the University of Michigan in 1885, and first became connected with the city of Chicago in 1888, as Assistant Engineer in the Bureau of Streets. Since then he has been in charge of construction on the water works tunnels and in charge of pumping stations. In 1910 he became Assistant City Engineer.

SHIRLEY, MAJ. JOSEPH W., Chief Engineer of the Topographical Survey, has been appointed by the Mayor as the city's representative on all work being done by the State Roads Commission within the city limits. Upon Major Shirley will devolve the responsibility for any delays which any of the municipal departments might occasion with the good roads work.

SLOAN, JOSEPH E., has been appointed Fire Chief of Newark, N. J.

VAN AMBURGH, CHARLES, has been re-appointed Superintendent of Highways of Broome County, N. Y., with headquarters at Binghamton.

WEBB, DR. DE WITT, is the new Mayor of St. Augustine, Fla.

INDUSTRIAL NEWS

Cast Iron Pipe.—Chicago: The leading pipe interest is busy filling orders placed in the spring. Although prices are firm, an advance is not expected. Quotations: 4-inch, \$25.50; 6 to 12 inch, \$24.50; 16-inch and up, \$24. Birmingham: The rate of production continues below normal and in no case has stock accumulated to any appreciable extent. Quotations are considered nominal as follows: 4 to 6 inch, \$22.50; 8 to 12 inch, \$22; over 12 inch, average, \$21. New York: The general market continues very quiet. Quotations: 6-inch, car loads, \$21 to \$22.

Lead.—Prices are somewhat firmer, but demand is light. Quotations: New York, 4.375c.; St. Louis, 4.225c.

New Life Net.—A test of a new life net was recently made in Schenectady, N. Y., by Fire Chief Henry R. Yates, Commissioner of Public Safety James C. McDonald, Captain Sanford Alberts, designer and maker of the net, and William Jensen, chief rigger at the works of the General Electric Company. Bags of sand weighing 130 pounds, thrown from second and third story windows, were caught without injury to the net. The net will be used by one of the local companies. It is stated that the nets can be made for \$17.

Test of Paving Brick.—The Henry S. Spachman Engineering Co., Philadelphia, Pa., have reported on a series of tests made for the Augusta Vitrified Block Company of paving brick made at their Harlem, Ga., plant. The losses by abrasion of different lots tested were as follows: 22.06; 22 and 20.2.

Gives Asphalt for Highway.—The Pittsburg-Salt Lake Oil Co., Salt Lake, Utah, has sent a communication to the Commercial Club offering to give sufficient crude asphalt from its Sunnyside deposits to surface a road 40 miles long from Salt Lake through Davis County. The estimated quantity needed is 60,000 tons.

Trinidad Asphalt Oil.—The tank steamer *Prentia*, loaded with 3,800 tons of crude oil for Perth Amboy, N. J., is the first shipment of oil from Trinidad. Other boats are to be used, and shipments every ten days are expected. Oil can be discharged into steamer tanks at the rate of 2,400 barrels per hour through 10-inch mains extending from the land tanks and reservoirs along the 1,700-foot pier. The oil refinery at La Brea is now in operation. Many tanks have been constructed to care for the products. The works have a daily capacity of treating 3,000 to 3,500 barrels of crude oil.

Show Engine.—The auto fire engine contracted for from the American-La France Fire Engine Co., Elmira, N. Y., by the city of Waterbury, Conn., will be exhibited at the convention of International Association of Fire Engineers, Milwaukee, Wis., September 19-22. The engine is the first of this special kind to be built by the company.

Concrete Paving.—R. S. Blome and Co., Chicago, Ill., has notified the city of Spokane, Wash., that it will be held responsible for payment of a royalty to the company for the paving of Division Street between Sprague and Fourth Avenue. The sum of \$3,150.20 is demanded, which amounts to 35 cents per square yard on 8,872 square yards of pavement. The street has just been paved with concrete by John Fife.

Carbolineum.—C. S. McKinney Company, 50 Church Street, New York City, who are the owners and sole selling agents of three carbolineum wood-preserving companies, issue a pamphlet explaining that all carbolineum is not alike. Their highest grade is called Cop'R-oil, another grade Bincere, and ordinary cheaper grades have no special names. It should not be assumed that the low grades are unsuitable for some purposes. The Cop'R-oil carbolineum is a heavy oil of coal tar having a high boiling point with powerful antiseptic chemicals added. The following description and definition of carbolineum appeared in McGraw's Electrical Dictionary for Buyers (1909):

CARBOLINEUM. This name covers a multitude of different compounds made in different ways by different manufacturers. The better class of manufacturers and chemists seek to confine the name to compounds containing the products of the destructive distillation of coal tar, which distill over at the higher temperatures, and are known as "heavy oils" in contradistinction to "light oils or creosote oils." These heavy oils, freed from substances which are solid at low temperatures, such as naphthalene, are powerful and persistent antiseptics in themselves alone, but they are improved by the addition of other antiseptics, such as zinc chloride and the copper salts. It is easy to doctor up low grade oils until they look and smell right, though valueless as wood preservatives, hence Carbolineum should be subjected to rigid chemical tests, or purchased from reliable dealers, who are competent to select and test the products which they sell. There is no proprietorship in either the name "Carbolineum" or the method of manufacturing it, and all brands of Carbolineum are "genuine," though some may be worthless. Carbolineum is the name given to a modification of Bethel's process of preserving wood, patented in England in 1838 and introduced into Germany by Brönnner in 1846, and it has been extensively used since that time in all parts of the world, as an efficient and a comparatively cheap wood preservative, convenient to apply at the place of use by unskilled labor.

Fire Extinguishing Compound.—In the presence of Deputy Fire Chief Thomas Lally, New York Fire Department, and several experts who are making a study of scientific fire fighting, officials of the Standard Oil Company fought a blaze with chemicals and within a minute subdued flaming oil, such as has, on many occasions, caused much damage in the large plant in Kent avenue, Williamsburg. Four times men set fire to oil and gasoline, which for the purposes of experiment had been placed in a small isolated tank, and each of these promising fires was extinguished quickly by the introduction into the tank of aluminum sulphate, bicarbonate of soda and licorice.

The new system comprises, in addition to the necessary fire pump, two tanks of a combined capacity of 38,000 pounds of chemicals. There is a small quantity of water in the tanks for the purpose of dissolving the chemicals. One of the tanks is used for a solution of aluminum sulphate and licorice in the proportion of 18,000 pounds of aluminum to 8,000 pounds of licorice. In the other tank there are 12,000 pounds of bicarbonate of soda.

The two solutions are mingled as they are forced through the pipes and as they reach the tank in which the fire has started they swell into a yeast like froth, spread across the surface of the burning liquid, separate the liquid from the air and put out the fire.

Modern Municipal Illumination.—With this caption the Flour City Ornamental Iron Works, Minneapolis, Minn., has issued its new de luxe edition of its Lamp Standard Department. The shape of the brochure, long and narrow, is suited to the proper display of the different styles of standards of classical designs made by the company. A list of a few cities having large installations of Corinthian standards is given; they are Atlanta, Ga.; Duluth, Minn.; Minneapolis, Minn.; Jacksonville, Fla.; Fort Dodge, Ia.; Milwaukee, Wis.; Oklahoma City, Okla.; Winnipeg, Canada. As indicating the high character finish which has been done by the Flour City Company, it may be mentioned that all of the ornamental standards on Federal buildings throughout the country are of their manufacture.

One of their devices used in connection with police call systems is worth mentioning, because the lights commonly used for calling officers are far from ornamental. On certain standards, in the place of the iron bulb or acorn forming part of the ornamentation of each bracket, a colored globe is substituted. This is not out of harmony with the design and answers the purpose perfectly.

The brochure illustrates two Corinthian, two Capital and two Egyptian designs. Indicating the substantial character of the construction is a photograph of the Nicollet Avenue fire of last winter, when the standards were uninjured, although the buildings on the opposite side of the street were damaged.

Imhoff Royalty.—In the course of a discussion regarding the relative merits of an Imhoff system of sewage disposal and a trunk sewer for the city of Passaic, N. J., the fact was brought out that the royalty charged by the Imhoff company would be \$400 for each 10,000 of population served.

Contracting Firms Merged.—The McCartin Contracting Company and the Southern Asphalt and Contracting Company, both of Birmingham, Ala., have combined their capital and interests and the name of the latter will be retained. The capital of the new company will be \$50,000. Officers have been elected as follows: Eugene Fies, president; J. R. Copeland, vice-president; John McCartin, vice-president; John Donaldson, vice-president, and John Crawford, secretary. The new organization starts out with \$200,000 work on hand. It is the intention of the company to bid on work in all the Southern cities.

Garbage Plant.—Citizens of Bridgeport complain that the odors from the new garbage plant are very similar to those from the old one. Commissioner Whitcomb, who has visited the plant, says that there is no accumulation of garbage in the pit to speak of, and he thinks the odors are created by gases generated during the process of reduction.

Mechanical Filtration Plant.—The mechanical filtration plant at Cohoes, N. Y., built by the New York Continental Jewel Filtration Company, has been finished and placed in operation. It will be operated several months before it is finally accepted by the city.

Portable Pumping Plants.—Commissioner Edwards of the New York Street Cleaning Department is looking up the subject of portable gasoline pumping plants to be used for pumping river water into street flushing machines. A pumping capacity of about 300 gallons a minute is desired. The scarcity of Croton water, as well as the question of economy, is the cause of the innovation.

Inspecting Asphalt Pavements.—Francis P. Smith, of Dow and Smith, chemical engineers, recently looked over 30 miles of Syracuse pavement in company with Mayor Schoeneck, Commissioner of Public Works F. M. Westcott, Deputy City Engineer Isaac Schwartz and Superintendent G. H. Beebe of the Bureau of Water. They also visited the asphalt mixing plant of the Warner-Quinlan Company in Fulton Street. Mr. Smith returned to New York well supplied with samples of pavement for analysis and report.

Information Bureau.—The Salvador government now maintains an information bureau to report upon the orders which the various departments of the government may consider placing abroad or in the home market. Manufacturers interested should send catalogues and prices addressed to the Oficina de Informacion, Ministerio de Agricultura, San Salvador.

Auto Engine.—A Webb auto fire engine has recently been installed in the Vailsburg section of Newark, N. J. Under Acting Chief Sloan a test was made. The apparatus was sent six-tenths of a mile and the men laid six lengths of hose in two minutes and fifty-four seconds after the call was sounded.

Auto Combination Apparatus Tested.—An auto combination hose and chemical wagon built for the Sanford, N. Y., fire department by the American La France Company was recently tested. The auto is 48 horsepower, with eight cylinders, though 72 horsepower is developed under speed. Hills were climbed at speeds varying from 20 to 46 miles an hour. Mayor Ellison, Fire Commissioners Amey and Cole, Fire Chief McCarthy, several of the city's Aldermen and others to the number of 11, rode on the truck during the demonstration.

Municipal Lighting Plants.—When the Chamber of Commerce of Manette, Ga., recently made an investigation of municipal ownership of lighting and water plants, it found that of the 89 municipally owned lighting plants in Georgia, 51 had been built by J. B. McCrary Company, Atlanta, Ga.; of the 107 municipally owned water works, 33 were built by the same company. Joseph M. McCrary, president of the company, is an engineer. Altogether 300 municipal plants have been built by this company. The company has a bond department which assists the towns in disposing of their securities.

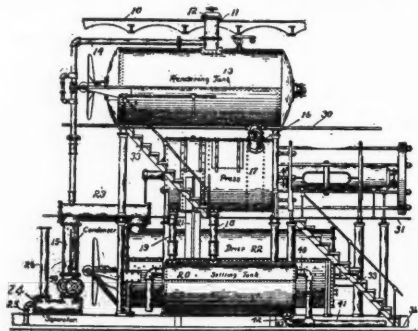
Trinidad Maltha.—Dr. Albert Sommer, recently connected with the Texas Company, will take charge of a new department of the Barber Asphalt Paving Company. Dr. Sommer received the degree of Doctor Ingenieur, Dresden University, in 1903. Later he was assistant in the chemical laboratory of Prof. Walter Hempel, Dresden University, whose specialty is technical organic chemistry. In 1910 Dr. Sommer was lecturer on Petroleum and Its Products, School of Marine Engineering, United States Naval Academy, Annapolis.

Dr. Sommer is already actively engaged in the enormous amount of development work undertaken immediately upon the discovery of the Trinidad maltha in the neighborhood of the asphalt lake. He describes this discovery as the "mother substance" of Trinidad asphalt and one that, having no exact counterpart among the malthas heretofore known to the asphalt industry, is destined to play an important part in the future progress of street paving and road building.

PATENT CLAIMS

994,047. SYSTEM OF APPARATUS FOR TREATING GARBAGE. Frederick G. Wiseloge, Indianapolis, Ind., assignor to United States Construction and Utilization Company, Rochester, N. Y., a Corporation of New York. Serial No. 451,106.

In a refuse reduction plant, the combination of a receiving floor, a pair of rendering tanks arranged beneath said floor and having receiving portions in said floor, a press arranged beneath the rendering tanks, independent connections between each rendering tank and press, a drier arranged beneath the press, a connection between the pulp discharge of said press and the drier, a settling tank also arranged beneath the press, a connection between the



liquid discharge of the press and the settling tank, a valved draining discharge leading from said settling tank at its lowest point, an overflow passage leading from an upper portion of the settling tank, a condenser, a connection between said condenser and the rendering tanks and drier, a vacuum pump connected with said condenser so as to maintain a vacuum within the drier and rendering tanks, and a separator connected with the discharge side of said pump, and having a liquid discharge pipe and a gas discharge pipe, all combined and arranged as set forth.

993,487. ROAD-SCRAPER. Jacob Williamson, Ava, Ill. Serial No. 590,938.

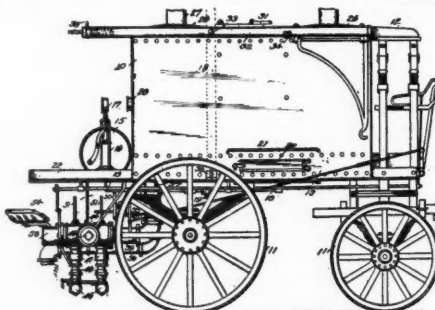
In a road grading machine, a pair of scraper beams capable of being changed in position, one in advance of the other, and provided with downwardly extending cylindrical portions at their rear, a scraper con-



nected between the beams and provided with tubular members in which the downwardly extending portions of the beams are swiveled, in order to permit a swiveled action between the beams and the scraper when the beams are changed in position relative to one another.

993,618. APPARATUS FOR TREATING ROADS. Henry K. Potter, Boston, Mass., assignor to Studebaker Brothers Manufacturing Company, South Bend, Ind., a Corporation. Serial No. 588,337.

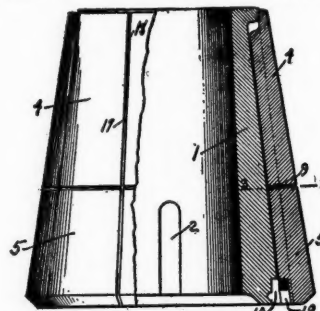
The combination with a vehicle running gear, of a tank mounted thereon, a fire box under the tank, T-rails on the running



gear, said rails having their webs upstanding, and the side walls of the tank being extended to form the side walls of the fire box, and secured to said upstanding webs on the outside thereof, the bottom of the fire box being secured to the inner horizontal flanges of the T-rails, and a spraying device connected to the tank.

993,783. CRUSHER-HEAD. Volney W. Mason, Jr., New York, N. Y., assignor to Edgar Allen American Manganese Steel Company, Augusta, Me., a Corporation of Maine. Serial No. 588,157.

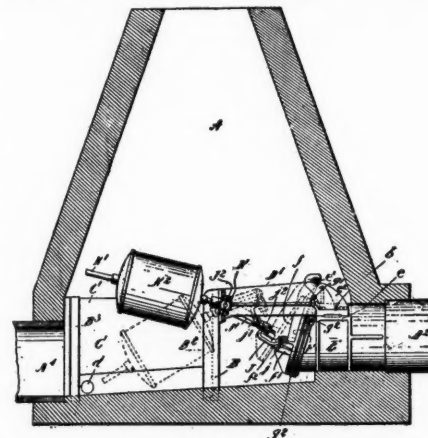
In a crusher head, a core having a series of vertically extending grooves; a series of circumferentially arranged segments spaced apart from one another and occupying the upper portion of the exterior surface of said core, and having each a rib adapted to enter one of the grooves aforesaid and to co-operate therewith to



hold the segments in place upon the core; a second series of circumferentially arranged segments spaced apart from one another and occupying the lower portion of the exterior surface of said core, and having each a rib similar to the ribs of said first mentioned segments; and means interposed between adjacent ends of aligned segments of said two series of segments whereby they are spaced apart from one another.

993,587. REGULATOR - VALVE FOR SEWERS. Charles H. Dodd and Richard J. McNulty, Boston, Mass. Serial No. 521,665.

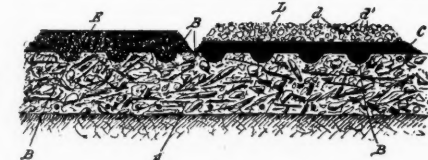
The regulator valve above described, comprising a nozzle, a gate, and means for supporting said gate comprising two arms mounted on said nozzle, each arm being slotted, a hinge rod adjustably mounted



in said slots to form a hinge for said gate whereby said gate may be adjusted on an axis transverse to the length of said nozzle, as well as toward and from said nozzle in combination with means for operating said gate.

994,092. CONCRETE ROADWAY. Edward M. Chadbourne, San Francisco, Cal. Serial No. 615,134.

The method of pavement construction which consists in providing an aggregate composed of a mixture of wear resistant stone of such size as to have a large percentage of voids and sand or equivalent having a smaller percentage of voids, the interstices in the sand being of such size as to exert capillary attraction on a limpid



but normally non-fluid asphaltic binder, then heating the mixture of stone and sand and filling the interstices therein from the bottom capillary action, with a normally non-fluid asphaltic binder rendered limpid by the heat of the mixture of stone and sand, whereby a homogeneous layer is produced having no excess of either binder or aggregate.

THE WEEK'S CONTRACT NEWS

Relating to Municipal and Public Work—Street Improvements—Paving, Road Making, Cleaning and Sprinkling—Sewerage, Water Supply and Public Lighting—Fire Equipment and Supplies—Bridges and Concrete Work—Sanitation, Garbage and Waste Disposal—Police, Parks and Miscellaneous—Proposals and Awards.

To be of value this matter must be printed in the number immediately following its receipt, which makes it impossible for us to verify it all. Our sources of information are believed to be reliable, but we cannot guarantee the correctness of all items. Parties in charge of proposed work are requested to send us information concerning it as early as possible; also corrections of any errors discovered.

BIDS ASKED FOR

STATE	CITY	RECEIVED UNTIL	NATURE OF WORK	ADDRESS INQUIRIES TO
STREET IMPROVEMENTS				
Ohio.....	Cincinnati.....	June 16, noon.....	Improving the Loveland and Madeira road; constructing culvert and approaches on Betts ave. in Springfield township.....	Stanley Struble, Pres. Bd. Co. Comrs.
Ohio.....	Toledo.....	June 16, noon.....	Improving Kelsey ave., by paving central 30 ft. with vitr. brick on concrete foundation, necessary grading, curbing, retaining walls, drainage, etc.....	J. R. Cowell, Dir. Pub. Service. Amos E. Ehle, Town Clerk. Oscar C. Ferry, Asst. Clk. Bd. P. W. Board Pub. Works. Board Affairs. Timothy Dasey, Mayor.
Indiana.....	E. Germantown.....	June 16, 7 p.m.....	Constructing cement sidewalks in various streets.....	J. M. Nicholson, Boro. Clerk.
Massachusetts.....	Holyoke.....	June 16, 2 p.m.....	Furnishing paving blocks.....	C. F. Redmon, Turnpike Supervisor.
Massachusetts.....	Springfield.....	June 16.....	Paving about 5,200 sq. yds., three streets.....	S. A. Arnold, Clerk.
West Virginia.....	Bluefield.....	June 16, 7:30 p.m.....	Macadamizing Princeton ave. with water-bound macadam.....	Geo. Johnson, Clerk.
New York.....	Little Falls.....	June 16.....	Paving and curbing various streets.....	J. P. Congdon, Secy. Rossford Rd. C.
Pennsylvania.....	Derry.....	June 16.....	Paving with vit. brick about 9,650 sq. yds.; 4,850 lin. ft. combined curb and gutter.....	Francis G. Ward, Commissioner.
Kentucky.....	Paris.....	June 17.....	Constr. 2½ miles of new turnpike, ten miles west of Paris.....	Wm. Barneck, City Engr.
Ohio.....	Canfield.....	June 17, noon.....	Grading and paving with brick on furnace slag foundation 948 lin. ft. of Broad street. Estimated cost \$6,232.26.....	John J. Brown, Pres. Bd. Trustees.
Ohio.....	Hamler.....	June 17, noon.....	Grading, curbing and paving Belton street.....	H. H. Lotter, City Engineer.
Idaho.....	Pocatello.....	June 17, noon.....	Constr. macadam road between Rossfork and Gibson in Bing-ham County.....	Wm. T. Richards, County Auditor.
New York.....	Buffalo.....	June 17, 11 a.m.....	Furn. paving stone, curbing, sand, gravel, crushed stone and bit. dressing for mac. roads for fiscal year 1911-12.....	County Commissioners.
Minnesota.....	Albert Lea.....	June 19, 5 p.m.....	Paving with creosoted wood, vit. brick, mineral rubber, bitu. sandstone or concrete 32,280 sq. yds.....	Jas. C. Holland, City Clerk.
New York.....	White Plains.....	June 19.....	Constr. a ten foot center strip of macadam asphalt in portion of Church street.....	John M. Murch, County Auditor.
Washington.....	Vancouver.....	June 19.....	Street improvements, consist. of paving, grading, macadamiz., etc., estimate cost \$292,780.....	R. Milton Ford, Village Clerk.
Indiana.....	Anderson.....	June 19.....	Constructing gravel roads in various townships.....	John T. Geary, City Clerk.
Washington.....	Hoquiam.....	June 19.....	Constructing the Emerson road, est. cost \$17,000.....	John E. Potter, President.
Montana.....	Havre.....	June 19, 8 p.m.....	Constructing concrete walks and curbs.....	Ed. Minton, Town Clerk.
Texas.....	Galveston.....	June 19, 11 a.m.....	Grading, rebuilding culverts and resurfacing county road from Virginia Point to Texas City Junction.....	Wm. T. Easton, City Clerk.
Michigan.....	Highland Park.....	June 19, 7:30 p.m.....	Paving various streets with creosote block, asphalt block, cedar block and reinforced concrete.....	Geo. Warriner, Chm. Bd. Selectman.
New York.....	Yonkers.....	June 19.....	Regulating and grading Nepperhan ave. and setting flagging.....	George T. Bouton, Clk. Bd. St. Com.
Pennsylvania.....	Derry.....	June 19, 8 p.m.....	Excavating, grading and paving with vit. brick right of way of Westmoreland County R. R. Co. on North Chestnut street.....	E. D. Fouse, City Clerk.
Pennsylvania.....	Media.....	June 19, noon.....	Resurfacing portion of Monroe st., about 3,100 ft. in length.....	J. S. Hanlon, City Clerk.
Michigan.....	Dowagiac.....	June 19.....	Grading High st. and paving with 6-in. concrete surfaced with bitumen; combined curb and gutter.....	Frank M. Kerr, Chief State Engr.
Massachusetts.....	Palmer.....	June 19.....	Rebuilding and resurf. Main st. in the village of Bondville.....	H. E. Devlin, City Engineer.
New Jersey.....	Jersey City.....	June 19, 2 p.m.....	Repaving Ninth street and improving Enos place.....	Jos. E. Washington, Chm. Bd. Co. C.
Georgia.....	Newnan.....	June 19, 8 p.m.....	Laying 22,000 sq. yds. smooth pavement.....	County Comrs.
New York.....	Auburn.....	June 20, 8 p.m.....	Bldg. subways and vitrified brick pavement on State street.....	Geo. W. De Voe, Boro. Clerk.
Louisiana.....	New Orleans.....	June 20, noon.....	Bldg. highways from North st. to Bayou Sara road, Baton Rouge and from Mansfield to Logansport.....	James N. Norris, County Compt.
Kansas.....	Newton.....	June 20, 10 a.m.....	Paving 5,000 sq. yds. with brick asphalt filler.....	Stanley Struble, Pres. Bd. Co. Comrs.
Tennessee.....	Springfield.....	June 20, noon.....	Grading, ditching and macadamizing about 50 miles of public roads in Robertson County.....	C. H. Pudolph, Chm. Commissioners.
Ohio.....	Columbus.....	June 21.....	Improving various roads in Franklin Co., about 8 miles; grad. the grounds of tuberculosis camp, constr. concrete walks.....	Jas. T. MacMurray, City Clerk.
New Jersey.....	Spotswood.....	June 22, 8 p.m.....	Laying 2,400 ft. of concrete curbing.....	H. E. Wells, County Clerk.
Pennsylvania.....	Wilkes Barre.....	June 22, 2 p.m.....	Repairing with bituminous macadam the Kingston and Dallas Turnpike, in Kingston township.....	State Highway Com.
Ohio.....	Cincinnati.....	June 23, noon.....	Repairing portion of Blue Rock pike; also for oiling Colerain pike in Colerain twp. and Cleves and Bridgetown pike in Green and Miami townships.....	Bd. Superv. Wise County.
Dist. of Col.....	Washington.....	June 23, 2 p.m.....	Laying gutters and bituminous macadam pavement and setting curb on various streets.....	John Scott, Clk. Bd. Co. Comrs.
New Jersey.....	Plainfield.....	June 26, 8 p.m.....	Paving about 40,000 sq. yds. with plain and bituminous.....	J. D. Miller, Chm. Co. Comrs.
Nebraska.....	Lincoln.....	June 27.....	Paving portions of roads Nos. 667 and 1225, 9,564 sq. yds. Class "C" and "G"; 10,760 lin. ft. artificial stone curb.....	Stanley Struble, Pres. Bd. Co. Comrs.
Virginia.....	Norfolk.....	June 28.....	Constructing new highways in Wise county.....	A. B. Maupin, City Engr.
Tennessee.....	Wise Ct. House.....	June 28, 11 a.m.....	Constructing about 81 miles of county highway.....	
Ohio.....	Columbus.....	June 28.....	Furnishing and applying 10,489 gals. surface treatment on Harrisburg Pike; 15,739 gals. on Sunbury Pike and 13,630 gals. on National Road.....	
Pennsylvania.....	Greensburg.....	June 29, 11 a.m.....	Construction and permanent improvement of four county roads about 68,348 feet.....	
Ohio.....	Cincinnati.....	June 30, noon.....	Treating with tar Hillside ave. and Warsaw pike; oiling Springfield pike in Springfield township.....	
West Virginia.....	Huntington.....	July 6, 1 p.m.....	Paving various streets with vit. brick, asphalt, bitulithic, tarvia or asphalt block.....	
SEWERAGE				
Ohio.....	Piqua.....	June 16, noon.....	Constructing a sanitary sewer in South Main street.....	T. D. McClay, Dir. Pub. Service.
Missouri.....	St. Louis.....	June 16.....	Building Sewer Harlem Creek District No. 7.....	Maxime Reber, Pres. Bd. Pub. Imp.
Ohio.....	Niles.....	June 16, noon.....	Constr. sanitary sewers in Williams, Smith, Mechanic and Chestnut sts., necessary manholes, house connections, etc.....	J. E. Tregaskis, Clk. Bd. Control.
Ohio.....	Canfield.....	June 17, noon.....	Constructing storm water sewer in portion of Broad street.....	S. A. Arnold, Clerk.
California.....	Oakland.....	June 17, 11 a.m.....	Constructing main sewers together with lateral sewers in Sewer Districts 1, 2, 3 and 4.....	Jas. W. Nelson, Secy. Bd. Pub. Wks.
Minnesota.....	Brainerd.....	June 19.....	Constructing a general sewer.....	V. N. Roderick, City Clerk.
New York.....	Long Island City.....	June 19, 11 a.m.....	Reconstructing Harris ave. sewer; bldg. sewers in Jackson and other avenues.....	Lawrence Gresser, Boro. Pres.
New Jersey.....	Roosevelt.....	June 19.....	Constructing sanitary sewers.....	Borough Clerk.
Georgia.....	Toccoo.....	June 20.....	Constructing a sewerage system.....	D. E. Hogsd, Chm. Sewerage Com.
South Dakota.....	Madison.....	June 20.....	Installing a sewer. Estimated cost \$65,000.....	Chas. A. Trimmer, City Engr.
Wisconsin.....	Janesville.....	June 21, 2 p.m.....	Bldg. sewers in Districts 3, 4, 11, 15 and 16.....	John C. Nichols, Chm. Str. Asses. C.
Ohio.....	Dayton.....	June 21, noon.....	Constructing storm water sewers in various streets.....	J. C. Ely, Dir. Pub. Service.
Massachusetts.....	Attleboro.....	June 21, 3 p.m.....	Laying c. i. and vit. pipe sewers; building brick manholes, etc.....	J. J. Van Valkenburgh, Engineer.
Wisconsin.....	Wausau.....	June 22.....	Constr. 2,300 ft. of 5-ft. reinforced concrete sewers and 1,000 ft. vit. pipe sewer.....	B. C. Gowen, City Engr.
South Dakota.....	Aberdeen.....	June 26.....	Constr. about 1,860 ft. of 18 and 8-in. pipe sew. and 5 manholes.....	F. W. Raymond, City Auditor.
North Carolina.....	Red Springs.....	June 27, 3 p.m.....	Constr. a sewer system including 4½ miles of 8 to 15-inch pipe.....	A. B. Pearsall, Chm. Bd. Pub. Wks.

BIDS ASKED FOR

STATE	CITY	RECEIVED UNTIL	NATURE OF WORK	ADDRESS INQUIRIES TO
SEWERAGE (Continued)				
Minnesota.....	Morris.....	June 27, 8 p.m.....	Constr. 3,232 ft. of 8-in. sewer, 4-in. tile drain, manholes, flush tank, etc.	C. B. Burpee, City Clerk.
New York.....	Hempstead.....	June 27, noon.....	Bldg. about 122,930 lin. ft. 8 to 20 in. vit. pipe, about 2,000 lin. ft. 8 to 18-in. cast iron pipe, about 115,300 cu. yds. excavation, 3,000 vert. ft. concrete manholes, 113 flush tanks, 445 manhole covers, 18,000 lin. ft. 6-in. vit. pipe for house service, two pumping plants and one disposal plant.	M. O. Hedges, Clk. Vil. Bd.
Maryland.....	Baltimore.....	June 28.....	Constr. storm water sewers in the bed of Jones' Falls, preliminary to constructing boulevard over Falls.	J. H. Preston, Mayor.
New York.....	Hudson.....	June 29, 6 p.m.....	Constr. 10-in. vit. tile sewer on Green street.	M. J. O'Hara, City Engineer.
California.....	San Jose.....	July 3.....	Construct septic tank for County hospital.	City Clerk.
South Dakota.....	Madison.....	July 6, 8 p.m.....	Bldg. sewer system about 31,465 lin. ft. 6 to 18 in. vit. pipe.	George H. Waskey, Mayor.
WATER SUPPLY				
Colorado.....	Colorado Spgs...	June 16, 10 a.m.....	Furn. and laying 63,785 ft. of cast iron pipe 4 to 16-in., and 43 tons special castings; alternate bids for 12 and 16-in. steel pipe; 143 gate valves and boxes; 53 tons pig lead, manh., etc.	H. F. Avory, Mayor.
Indiana.....	Evansville.....	June 17, 10 a.m.....	Furnishing about 250 tons of c. i. pipe and spec. valves, meters.	Henry L. Heilman, Secy. Bd. W. C.
Kansas.....	Cherryvale.....	June 19, noon.....	Bldg. water purification plant, storage reservoir, etc.	E. E. Bellamy, City Clerk.
Ontario, Can...	Toronto.....	June 20, noon.....	Laying about 3,500 ft. of riveted steel pipe 6-in. in diameter in Lake Ontario.	F. S. Spence, Chm. Bd. Control.
Alabama.....	Gadsden.....	June 21.....	Furn. about 900 tons of water main, 20 tons of specials, 20 tons of lead, 30 valves and 26 hydrants.	M. E. Jones, Supt.
New York.....	New York.....	June 21, 2 p.m.....	Furnishing and driving test wells in Kings, Queens and Nassau counties; hauling and setting fire hydrants, etc.	H. S. Thompson, Comr. Water. Sup.
Vermont.....	Ft. Ethan Allen.	June 21, 10 a.m.....	Building addition to pump house, installing electrically driven pumping machinery; building concrete reservoir; remodeling electric lighting system.	R. J. Fleming, Capt. 10th Cav. Qm.
Indiana.....	Hammond.....	June 21, 10 a.m.....	Furnishing 6,400 feet 36-in. standard c. i. water pipe and 4,950 feet 16-in. c. i. water pipe.	A. R. Ebert, Chm. Bd. Pub. Wks.
New Jersey.....	Crosswicks.....	June 22.....	Constr. a system of water works.	Geo. B. Thorn, Secy. Cross. Wt. Co.
Texas.....	Galveston.....	June 22, noon.....	Furn. compound Corliss fly-wheel pump of 4,000,000 gals per day capacity, including piping, valves, foundations, etc.	W. D. Masterson, City Supt. of Elec.
Arkansas.....	Mena.....	June 23.....	Constr. new distribution system for water works Dist. No. 2; separate bids for material and construction; 780 tons c. i. pipe and special castings; about 40,000 ft. of 4 to 12-in. mains.	John Thompson, Chm. Bd. Imp.
Ohio.....	Euclid.....	June 26, noon.....	Laying 6-in. water mains in four avenues.	F. H. Schoaff, Village Clerk.
New Jersey.....	Bridgeton.....	June 27.....	Constructing complete pumping station and water filtration works, machinery, pumps, fillers, etc.	J. J. Jones, City Clerk.
Kentucky.....	Frankfort.....	June 27, 11 a.m.....	Constr. pipe line to Lakeland, consisting of 7,360 ft. 16-in. pipe, 21,680 ft. 12-in. pipe, 10,690 ft. 8-in. pipe.	Albert Scott, Pres. Ken. St. Bd. Con.
Quebec, Can...	Montreal.....	June 29, noon.....	Installing pumping machinery, blower and cranes at filtration plant.	L. N. Senecal, Secy. Bd. Comrs.
Minnesota.....	Minneapolis.....	June 30.....	Furnishing filter equipment and devices.	Henry N. Knott, City Clerk.
Ontario, Can...	Ft. William.....	July 1.....	Selling equipment of municipal pumping and electrical generating plant, suitable for town of 5,000 inhabitants.	John Wilson, City Engineer.
Ohio.....	Cleveland Hghts.	July 5, noon.....	Building 10-in. water main in Cedar Roads.	H. H. Canfield, City Clerk.
BRIDGES				
Washington.....	Ritzville.....	June 16.....	Constr. a 2-span steel bridge across Palouse River.	County Commissioners.
Ohio.....	Cincinnati.....	June 16, noon.....	Building bridge on Dunlap Creek road, Colerain township.	Fred Dreihls, Clk. Co. Comrs.
Pennsylvania...	Sunbury.....	June 16, noon.....	Building bridge, Spurzheim street, Shamokin.	E. W. Young, Ch. Clk. Co. Comrs.
Maine.....	Mars Hill.....	June 17.....	Bldg. rein. conc. bridge, 66 ft. span, 24 ft. roadway.	W. M. Denman, Spring., Mass., C. E.
Indiana.....	South Bend.....	June 19, 11 a.m.....	Taking down old bridge and re-erecting an iron truss bridge in Penn township.	John W. Harbou, County Auditor.
Ohio.....	Lima.....	June 20.....	Constructing a concrete arch bridge.	Bd. County Comrs.
Pennsylvania...	Kutztown.....	June 20, 10 a.m.....	Constr. a reinforced concrete arch bridge.	A. L. Rhoades, County Comptroller.
Iowa.....	Eldora.....	June 22.....	Constr. a 7-span steel bridge 30 ft. wide with concrete floor over Iowa River, at Iowa Falls.	E. L. Marriage, County Auditor.
Ohio.....	Brookville.....	June 22, 10 a.m.....	Building superstructure bridge No. 239, Clay township.	Board Co. Comrs.
Ohio.....	Dayton.....	June 22, 10 a.m.....	Constr. superstructure on Bridge No. 239 over Wolf Creek in Clay township, including removal and purchase of old structure.	J. O. Donovan, Clk. Bd. Co. Comrs.
Ohio.....	Cincinnati.....	June 23, noon.....	Constr. bridges, culverts and approaches on County Club road in Sycamore, Silverton and Columbia townships.	Stanley Struble, Pres. Bd. Co. Comrs.
Virginia.....	Rocky Mount.....	June 24.....	Constr. two bridges in Franklin County, of iron.	J. H. Ferguson, Chm. Bridge Com.
Washington.....	Tacoma.....	June 26, noon.....	Constr. new bridges on 11th st. Separate bids on (1) substructure; (2) entire bridge except steel work, electrical and other machinery; (3) Furn. metal work, electrical equipment; (4) Erecting superstructure; (5) Constr. bridge complete, removing old bridges constr. temporary bridge.	City Clerk.
Texas.....	Houston.....	July 1.....	Constr. a reinforced concrete viaduct over Houston ship channel about 1,650 ft. long and 60 ft. wide.	F. L. Dormant, City Engr.
Pennsylvania...	Pittsburg.....	July 1.....	Constructing one concrete arch, estimated cost \$85,000.	City Clerk.
Ohio.....	Cincinnati.....	July 7, noon.....	Constr. concrete bridge at intersection of German and Compton roads in Springfield township.	Stanley Struble, Pres. Bd. Co. Comrs.
LIGHTING AND POWER				
Sask., Can....	Prince Albert...	June 26.....	Furn. hydraulic power and electrical power equipment.	C. O. Davidson, Secy.-Treas.
Arkansas.....	England.....	July 1.....	Building and operating an electric light plant under a 30-year franchise.	H. Galloway, Recorder.
Australia.....	Brisbane.....	Jan. 30, noon.....	Designs, supply and erection at Mount Crosby Pumping Station of alternatively one, two and three complete units consisting of power generating pumps and plants, etc.	Geo. Johnston, Albert St., S.&W.Bd.
FIRE EQUIPMENT				
Dist. of Col....	Washington.....	June 20, 2 p.m.....	Furn. 15,000 ft. 2 1/2-in. cotton covered rub. lined fire hose.	Cuno H. Rudolph, Commissioner
New Jersey....	Princeton.....	July 5.....	Furn. auto pumping engine.	E. M. Updike, Chm. F. & W. Com.
MISCELLANEOUS				
Arkansas.....	Benton.....	June 16.....	Erecting jail; separate bids for cell work.	W. H. Evans, County Comr.
Manitoba, Can.	Winnipeg.....	June 16.....	Erecting an incinerator.	M. Peterson, Secy. Bd. Control.
Indiana.....	Evansville.....	June 19, 7 p.m.....	Constr. earth work embankments surrounding filtration plant consisting of about 2,500 cu. yds.	Henry L. Heilman, Secy. Bd. W. C.
New Jersey....	Perth Amboy...	June 19, 8:30 p.m.....	Building fire house for Liberty Ladder Company.	Wilbur LaRoe, City Clerk.
Ohio.....	Toledo.....	June 20, noon.....	Constructing a market house.	J. R. Cowell, Director Public Service
Georgia.....	Macon.....	June 20.....	Constr. a new jail.	County Commissioners.
New York.....	N. Brighton, S.I.	June 20.....	Constr. building, destructor foundations, chimney base, connecting flues, dust pockets, ventilating ducts and adjuncts for the Clifton Refuse Destructor.	Geo. Cromwell, Boro. President.
California.....	Oakland.....	June 21, 11 a.m.....	Collecting and disposing of garbage and refuse.	James W. Nelson, Secy. Bd. P. Wks.
Indiana.....	Indianapolis.....	June 21.....	Collecting and disposing of garbage.	Edw. A. Ramsay, City Clerk.
Massachusetts...	Holyoke.....	June 23, 2 p.m.....	Constructing shelter for public playground.	Oscar C. Ferry, Assistant Clerk.
Indiana.....	South Bend.....	June 26, 10 a.m.....	Furn. 50 or more voting machines.	John W. Harbou, Auditor.
Ohio.....	Maumee.....	June 26, noon.....	Erecting a village hall building.	Geo. V. Raab, Village Clerk.
New Jersey....	Paterson.....	June 28.....	Collecting and disposing of garbage and refuse for term of 5 years from July 1.	T. S. Standeven, City Clerk.
Ontario, Can...	Ft. William.....	June 30, 5 p.m.....	Constructing a reinforced concrete subway.	John Wilson, City Engineer.
Indiana.....	Muncie.....	July 5.....	Constructing a new barn at County Infirmary, 40x50 ft.	County Auditor.

STREET IMPROVEMENTS

Andalusia, Ala.—Board of Revenue has asked for bids for construction of additional 10 miles of good road.

Richmond, Cal.—Bissell ave., 1½ miles, will be paved with asphalt; cost about \$150,000; plans by City Engineer Chapman.

Willows, Cal.—Glenn County is considering \$200,000 bond issue for roads and bridges.

Bridgeport, Conn.—Mayor Buckingham has recommended extension of Broad st. and wider approach to Stratford ave. bridge.

Jacksonville, Fla.—Estimates will be prepared of cost of paving Ionia and Clay sts. with vit. brick.

Dalton, Ga.—Catoosa County has decided to build road to connect with government pike at Ringgold.

Indianapolis, Ind.—Board of Public Works has adopted resolutions for improving eight streets.

Jasonville, Ind.—Board Public Works has decided to pave Meridian st.

Portland, Ind.—Jay County Commissioners have rejected all three bids submitted for construction of proposed O. S. Buckingham stone road in Bearcreek Township.

Princeton, Ind.—Gibson County Commissioners will soon let contract for constructing 3 gravel roads in Wabash Township at a cost of \$21,000.

Louisville, Ky.—Three miles of modern metal built and drained road will be constructed on Bardstown road through village of Fern Creek by the Fiscal Court of Jefferson County.

Plaquemine, La.—Police Jury is considering building of gravel road on Bayou, Plaquemine to Indian Village; distance, 9 mi.

Chicopee, Mass.—City will expend \$25,000 on permanent street improvement work.

Detroit, Mich.—Council has passed resolutions providing for the resurfacing of Larned, Madison, 24th and Beaubien sts., Clark and Warren aves; cost about \$41,970.

Houghton, Mich.—Village Council has authorized expenditure of \$1,500 to macadamize West Sheldon st.

St. Paul, Minn.—Repaving of 5th st. is being considered; either creosoted wood blocks, cost \$20,564.70, or sandstone, \$22,426.70, will be used.

Jackson, Miss.—Council has decided to expend \$85,000 on street improvements.

Butte, Mont.—Improvement of West Park st. is being urged.

St. Louis, Mo.—Bids will soon be asked by Commissioner of East Fourth St. District for paving East Fourth st. with creosote block or asphalt.—Claude Ringo, Secretary.

Hastings, Neb.—Extension of First st. paving is being considered by Council.

Bayonne, N. J.—Council has passed resolution for asphaltizing of Ave. C.; is also considering improvement of five streets.

Millville, N. J.—Council has decided to pave High st. with small gravel stones.

Rahway, N. J.—Council has decided to pave Main st. with asphalt paving brick or blocks.—Chas. H. Lambert, City Clerk.

Trenton, N. J.—Bids will be asked for repairing North Broad st. with Filbertine; Council has decided to pave Highland ave. with high grade asphalt and is considering paving of Ward Alley with monolith concrete.

Albany, N. Y.—Council has passed ordinance for repaving Livingston ave. and Black road and improving of Buchanan st.

East Syracuse, N. Y.—Village Board, through Superintendent I. W. Allen, is planning to resurface or fill practically every street in this village during season; macadam will laid on two blocks in Center st., one block in Upton st. and two blocks in McCool ave.

Mount Vernon, N. Y.—City has issued \$58,000 bonds for street improvements.

Niagara Falls, N. Y.—City Engineer F. S. Parkhurst has been instructed by Board of Public Works to estimate cost of paving 13th st. from Niagara st. to Ferry ave., and 11th st. from Ontario ave. to Portage road, and permanent sidewalks in 13th st. from Niagara st. to Ferry ave.

Oswego, N. Y.—Superintendent of Highways E. A. Howard has received notice from State Highway Commission that plans have been drawn for the improvement of Fruit Valley Southwest Oswego road, and that bids will soon be asked; road will be built this summer.

Rochester, N. Y.—Bids have been rejected and new proposals will be asked for laying Mt. Hope ave. cement walks.

Walden, N. Y.—Bids received for constructing 1½ miles of concrete sidewalk have been rejected; work will be done by the village; estimated cost 12c. per sq. ft.

Asheville, N. C.—City is considering paving of Magnolia ave. from Cumberland to

N. Main st. with bitulithic.—J. E. Rankin, Mayor.

Wilmington, N. C.—New Hanover County has voted \$50,000 bonds for road and bridge improvements and construction.—D. McEachern, Chairman County Commissioners.

Bryan, O.—Council has decided to pave East High st. with brick as soon as bonds can be sold and other preliminaries completed.

Cincinnati, O.—Cost of improving Turrill st. with brick has been estimated at \$13,927.50 and Moore st. with asphalt at \$2,772.75; Council has decided to improve Ella st. by paving with brick and setting with limestone curbs at cost of \$2,137, and macadamizing Herschel ave. with tar binder, cement combined curb and gutters at cost of \$8,338.75.

Cincinnati, O.—County Commissioners have directed plans and specifications to be prepared for improving Lower River road at a cost of \$10,254 and reported favorably on improving Sharon ave. and macadamizing of Springfield pike at a cost of \$20,000.

Cleveland, O.—Bids will be received June 19, noon, for \$45,000 street opening and \$15,000 grade crossing bonds.—H. L. Davis, City Treasurer.

Dayton, O.—Montgomery County Commissioners will expend about \$35,000 on state and county roads in vicinity of this city.

Tulsa, Okla.—City Commissioner Yeager and City Engineer Hughes have recommended eighty blocks of paving at total cost of about \$300,000.

McKeesport, Pa.—Repaving of Fifth ave. and Walnut st. is being considered.

Washington, Pa.—Improvement of 21 miles of road has been authorized by County Commissioners, highway to be built from bond issue of \$500,000.

Wellsboro, Pa.—Citizens have voted \$49,500 bonds to extend brick pavement.

Columbus, S. C.—Washington st. between Assembly and Sumpter sts. will be paved with wooden blocks.

Belton, Tex.—Precincts 4 and 5 of Bell County will vote July 1 on \$350,000 bonds for road improvements.

Teague, Tex.—Citizens will vote June 29 on \$30,000 bonds for street improvements.—J. H. King, Mayor.

Alexandria, Va.—Improvement of streets and sidewalks at cost of \$100,000 is being considered.

Seattle, Wash.—Cost of grading Lane st. has been estimated at \$152,475.

Spokane, Wash.—City Commission has decided to resurface Northwest boulevard; bids will be asked on various kinds of paving.

Green Bay, Wis.—Council has taken preliminary steps for proposed improvement of streets.

CONTRACTS AWARDED

Gadsden, Ala.—Building sidewalks on 3d st., to C. O. Duncan, \$5,999.10.

Little Rock, Ark.—By City to E. J. Wederstrom for paving in Water-Cross Paving District.

Longbeach, Cal.—Constructing the sea-side walk and bulkhead to F. W. Young, Los Angeles, \$96,000.

Los Angeles, Cal.—To Walter Overell for improving Michelterena st., \$3.90 per lin. ft., grading and graveling, 35c. per lin. ft. cement curb, 16c. per sq. ft. cement gutter, 334 sq. ft. vitr. block gutter, aggregate \$12,980.03.

Oakland, Cal.—Sidewalking Shafter ave. and other avenues, to Oakland Paving Co.

Pasadena, Cal.—Grading, graveling, etc., Washington st. between Hill and Lake sts., to J. E. Haddock, at \$10,800; paving with asphalt macadam South El Molino ave., between Colorado and California sts., to James M. Montgomery, \$27,136.

Pomona, Cal.—Street work on Texas st., to Louis Ferrill; grading and oiling, per lin. ft., \$1.80; curbing, per lin. ft., 30c.; sidewalk, per sq. ft., 10c.

Bridgeport, Conn.—Paving State st. for its entire length, from Broad street to its westerly terminus, with wood blocks, to the Parber Asphalt Company to furnish the blocks, \$1.80 per sq. yd., and to Van Keuran & Son, Jersey City, for laying pavement, \$1.25 per sq. yd.

Thompsonville, Conn.—By Selectmen for macadamizing of Pearl and South sts., to Amos D. Bridge Sons, inc.; contract calls for about 11,000 yds. 97c. sq. yd.

Peoria, Ill.—Paving North Orange st. with brick, to J. S. Allen Co., \$7,110.

Brazil, Ind.—To Jas. McGuire & Sons, city, \$2,148, and to L. W. Gibbens & Son, Saline City, \$4,200, for building roads.

Des Moines, Ia.—Paving 35th st., to Bryant-McLaughlin Paving Co., Des Moines, \$1.89 per sq. yd.

Fort Dodge, Ia.—Paving 7,500 yds. with concrete to Schweppe & Co. of the St. James Tile & Manufacturing Co., \$1.58½ per yd.

Harlan, Ia.—Laying 13,600 sq. yds. concrete pavement to G. Mancini, \$1.18; other bidders: C. H. Atkins, \$16,665; J. A. Beebe, \$16,679; McMahon & Son, \$16,768; Luna Construction Co., \$18,711; to C. N. Atkinson for 1,350 sq. yds., \$1.29; other bidders: McMahon, \$2,802; G. Mancini, \$2,324; Luna Construction Co., \$2,401; reselling \$4,885 lin. ft. curbing and gutter to Luna Construction Co., 30c.; 1,420 lin. ft. new curb, 30c.; 565 lin. ft. curb to C. N. Atkinson, 37c.; 770 lin. ft. new curb, 25c.; totals of bids: Luna Construction Co., \$2,175; W. R. Garland & Co., \$2,617; McMahon & Son, \$4,498; G. Mancini, \$2,791; C. H. Atkinson, \$2,616.

Lexington, Ky.—To Carey & Reed, for paving Vine st. with sheet asphalt, \$1.25 per sq. yd.

Lexington, Ky.—By Fiscal Court of Fayette County, to the Home Construction Co. for oiling reconstructed county roads.

Frederick, Md.—Paving South Market and East and West Patrick sts., to United Paving Co., Atlantic City, N. J., \$19,393.

Boston, Mass.—Building highway in Barnstable to E. J. Rourke, Abington, \$10,210; other bidders: M. R. Cavanaugh & Bros., \$11,014; Frank Williams, city, \$11,860 and Thos. Whalen & Co., Wollaston, \$12,114.

Bourne, Mass.—To M. J. Denaut & Co., 999 Chelmsford st., Lowell, for building 1½ miles of State highways, \$8,529.

Groveland, Mass.—Building oil gravel road through School st., to Jas. E. Watkins, Amesbury.

Duluth, Minn.—Paving 10th ave. East with asphalt to P. McDonnell, \$6,713.50.

Kansas City, Mo.—Building 6 miles of rock road between Overland Park and this city to Dobbins-Wilson Contracting Co., \$45,535.

St. Louis, Mo.—To Parker Washington Co., Taylor and Duncan aves. by the Board of Local Improvement for 19 street improvement contracts, \$45,948; work includes reconstructing street with wood blocks as follows: Taking up old paving, 85c.; granite curb, 83c.; marginal curb, 10c.; wood block, \$2.54; macadam, 1c.

Tilton, N. H.—Grading and surfacing with native stone about 5,500 ft. to Lane Constr. Co., Meriden, Conn.

Cape May, N. J.—To Lemuel Miller, city, for proposed 6-mile road as connecting link of Ocean Boulevard, \$23,751.62; foreign gravel.

Hackensack, N. J.—Road improvements: Franklin Turnpike, 3 sections, with asphalt concrete to G. M. Brewster Constr. Co., Hackensack, \$18,392; from New York State linesoutherly, distance of 9,362 ft., to same, \$35,744; from north line of Allendale to north line of Hohokus, to Geo. F. Brackett, Ridgewood, \$49,274, and for macadamizing road from Saddle River to Park Ridge, to E. Abrahams, Hackensack, \$22,962.

Newark, N. J.—To Ludwig Batt, South Orange, to lay two miles Bermudez asphalt macadam pavement on South Orange ave., South Orange, 97c. per sq. yd.; 3-in. coating on Washington ave., Belleville, 88c. per sq. yd.; to Osborn & Marcellis, Upper Montclair, for resurfacing Springfield ave., 2-in. amesite on one side and 2-in. on other, \$1.19 and 95c. per sq. yd.; resurfacing Bloomfield ave., Caldwell, to Bamberger & Chapman, city, 2-in. amesite, 95c. per sq. yd.

Dunkirk, N. Y.—Paving King st., to J. N. Doyle, Erie, Pa., \$23,000.

Lockport, N. Y.—Cement walk, curb and gutter on LeVan ave., to Contractors C. N. Stainthorpe & Co., \$1,839; other bidders: C. N. Whitore Co., at \$2,740; N. I. France, \$2,879.90; Harry E. Whitney, \$1,974.90, and John Irwin at \$2,670.

Schenectady, N. Y.—To Schenectady Contracting Co. for paving with sheet asphalt, in Huron st.; to Henry W. Golden for curbing, laying sidewalks and grading portion of Van Vranken ave.; to John L. Nolan for repaving with granite block a portion of Veeder ave.

Utica, N. Y.—Extension of traffic way on Boulevard from Elm to Mohawk st., to Harry W. Roberts & Co., fluxed Bermudez asphalt, bituminous binder, \$18,940.47.

Yonkers, N. Y.—To Thomas Grady for regulating, grading and otherwise improving Alexander st., Ashburton ave. to the south line of Wells ave., \$25,500, for granite block.

Ashtabula, O.—Paving Market and Hulbert sts., to Thos. Fitzgerald, about \$30,000.

Bucyrus, O.—To Mallory Bros. for building new Winchester road, \$5,308; Bucyrus-Marion road, \$3,541 and Milmore-Marion road, \$2,645.

Canton, O.—To John Wilson, Alliance, for paving with brick 1 mile of Lexington road, \$17,608 and 1 mile of Harrisburg road, \$18,449.

Celina, O.—Road construction to E. & G. Alexander, Mestemaker Pike, \$4,197 and Hemmelmarn Pike, \$5,885, both to be built of screening gravel; to Fishbaugh & Karch,

Chickasaw Pike, \$21,000, road to be built of stone; to Balmert & Flagler, Guggenbiller road, \$16,500, gravel.

Cincinnati, O.—To the Joe Grandison Construction Co. for change of route and improvement of Crokshana road, Summit, \$15,986.

Columbus, O.—Paving Summit st., 11th ave. to Mock road, to G. W. Paterson, \$63,000.

Lima, O.—Paving West Elm st. by the Board of Control, to Murray & Jameson, \$14,044; bituminous macadam will be used.

Perrysburg, O.—Paving 2d st. from Hickory to Pine, to T. J. Mulligan, Lima, \$38,335 for Wassell block with cement filler; George B. Campe, Toledo, has been engaged as engineer to look after work.

Wellington, O.—Paving with block paving S. Main and E. Main sts. from plans of Ohio Eng. Co., Elyria, to Lee & Driggs at \$23,991 and \$10,108, respectively; detail bid on S. Main st. is as follows: Excavation, 6,500 cu. yd., 30c.; drain, 3-in., 7,465 lin. ft., 3c.; concrete curb, 7,465 lin. ft., 34c.; split curb, 7,465 lin. ft., 40c.; machine dressed curb, 7,465 lin. ft., 40c.; concrete foundation, 12,700 sq. yd., 48c., or slag foundation, 12,700 sq. yd., 39c.; or limestone foundation, 12,700 sq. yd., 94c., or 98c., according to different makes; inlets, 12, ea., \$13; 12-in. sewer, 1,000 lin. ft., 40c.; 10-in. sewer, 500 lin. ft., 30c.; 8-in. sewer, 27c.; tar filler, 8c., and headers, 254 lin. ft., 36c.

Grants Pass, Ore.—To the Warren Construction Co. for laying 10,000 sq. yds. of bitulithic pavement.

Beaver Falls, Pa.—Paving number of streets to George B. Clifford, \$24,585; other bidders: Hunter & Hammon, \$25,350; A. V. Prunnell, \$26,329.70; and R. C. McQuiston & Co., \$31,020.70.

Olyphant, Pa.—Paving 1 mile of streets to R. C. Ruthven, \$24,283; other bidders: Stephen Flanagan & Son, \$24,837; R. P. McHugh & Co., \$24,555; Scranton Paving Co., \$24,283.

Reading, Pa.—To Fehr & O'Rourke, city, to lay brick in 6th st., \$11,969.90.

Wellsboro, Pa.—Constructing 9,162 lin. ft. of road extending from Kelsey Creek over West ave. to the Delmar Township line, distance 4,747 lin. ft., and from Main st., over Tioga st., to Delmar Township line, distance 4,415 lin. ft., to E. Whalen, Towanda, \$34,869; other bidders: H. G. Hinkle, Altoona, \$43,985; A. E. Francis, Punxsutawney, \$37,393; Stucker, Wellsboro, \$35,143; John Bradley, Corning, \$34,741.

Nashville, Tenn.—To J. G. Laubheimer, for construction of granitoid curbing and sidewalks on portions of several new streets, 12½c. for sidewalk and 30c. for curbing.

Dallas, Tex.—To Risley Bros. for furnishing Jackboro rock at 65c. per long ton.

Chehalis, Wash.—To Warren Construction Co. to pave streets with bitulithic; cost about \$57,740.

Everett, Wash.—Paving South Colby ave., to Atlas Construction Co., city, \$50,500.

Seattle, Wash.—Grading and curbing 25th ave., N. W., to J. H. Cullen & Co., \$18,910.50; other bidders: W. F. Manney & Co., \$19,664; N. McKinnon, \$20,709; A. Peterson & Co., \$25,086.50; Agassiz & Hadley, \$24,387.50; R. J. Barter, \$21,339.50.

Tacoma, Wash.—Paving Carr, N. 30th, N. 9th and Starr sts. with sandstone and asphalt, and other streets in Local Improvement Dist. No. 434, to Keasel Constr. Co., \$59,471.

Superior, Wis.—Building cement walks in the Third Ward, eight blocks, to Swan Holmquist, 63½c. per lin. ft. and 75c. per cu. yd. for filling; Fourth Ward contract, about five blocks of walk, to Bergman & Anderson, 58½c. per ft.; Eighth Ward, two contracts, to Ed. Johnson, 58 9-10c. and 59c. per ft.

BIDS RECEIVED

Stockton, Cal.—Grading and paving of county roads: Hogan road, F. C. McIntire, \$28,355; M. B. White, \$28,278.20; W. J. O'Brien, \$23,684.66; McDonald & Jenkins, \$25,993.55; West Side road, W. J. O'Brien, \$28,850; Cotton Bros., \$31,900.

Washington, D. C.—Furnishing Portland cement during the fiscal year ending June 30, 1912: (a) 45,000 bbls. Portland cement f. o. b. 14th and D sts. S. W., (b) alternate proposal, 30,000 bbls. Portland cement f. o. b. 14th and D sts. S. W.: Alpha Portland Cement Co., Easton, Pa., (a) \$1.61 per bbl., (b) \$1.61; National Mortar Co., Washington, D. C., (a) \$1.08, (b) \$1.08; Security Cement Co., Baltimore, Md., (a) 98c., (b) 98c.; Atlas Portland Cement Co., New York, (a) \$1.21, (b) \$1.21; Columbia Granite & Dredging Co., city, (a) \$1.70, (b) \$1.70; Rosslyn Supply Co., Rosslyn, Va., (a) \$1.49, (b) \$1.49.

Herkimer, N. Y.—Paving South Washington st. from Eastern ave. intersection to Smith st., Warren Bros. bitulithic, 5-

inch concrete foundation, \$2.20 per sq. yd., stone curbing 80c.; D. F. Strobel and B. Manion, Corning, metropolitan black brick \$2.29 per sq. yd., curbing 10c.; Frank M. Johnston, Corning, Mack-Shawville brick \$2.30 per sq. yd., curbing 8c.; 5-in. concrete foundation was provided for in both of the latter bids; bids totaled: Warren Bros., \$5,964.20; Frank M. Johnston, \$6,213.30; Strobel & Manion, \$6,051.96.

New York, N. Y.—Paving Bronx and Pelham Parkway, from Southern Boulevard to Butler st. road: Barber Asphalt Paving Co., 30 Church st., \$17,035; Thomas M. Hart, 2356 Lyon ave., \$13,233; Sicilian Asphalt Paving Co., 41 Park Row, \$16,883; Uvalde Contracting Co., 1 Broadway, \$17,492; Clarence L. Hill, Clerk of Park Board.

Dayton, O.—Low bidders upon recent letting of street improvement contracts: Troy, from Leo to Valley, J. O. Shoup, limestone \$37,588, berea \$37,698, cement \$37,518; Lexington ave., from Broadway to Deal ave., J. E. Conley, limestone \$29,310, berea \$28,977, cement \$28,520.

Perrysburg, O.—Paving 2d st.: brick, Garrigan Bros., Toledo, \$38,335; M. F. O'Sullivan, Toledo, \$40,569.60; A. A. Reilly, Toledo, \$44,204.76; F. E. McKinney, Toledo, \$44,872.80; D. J. Mulligan, Lima, \$35,538.68; Hennessy & Bro., Piqua, \$37,820.80; T. S. Saxton Co., Richmond, Ind., \$37,820.80; W. W. Hatch, Detroit, \$29,092.62; sheet asphalt, C. Marsman, Grand Rapids, Mich., \$41,667; asphalt block paving, Asphalt Block Paving Co., Toledo, \$40,064.

Butler, Pa.—Paving First st. and Brugh ave.: Norman J. Boyer on 1st st., excavation 35c., paving \$1.12 to \$1.30, pitch filling 15c., sand filling 2c., cement curb 18-in. curb 60c., 24-in. cement curb 70c., stone curb 52c., resetting stone curb 50c., repaving \$1 per sq. yd.; Brugh ave., excavating 30c., paving \$1.20 to \$1.27, repaving \$1; 18-in. cement curb 57c., 24-in. cement curb 70c., pitch filling 13c., sand filling 2c.; Tony Morelli, 1st st., excavating 29c., paving \$1.10, repaving \$1, pitch filling 15c., sand filling 2c., cement curb 56c. and 65c., stone curb 48c., resetting curb 30c.; Brugh ave., excavating 29c., \$1.13 to \$1.35 for paving, \$1 for repaving, cement curb 56c. to 65c., stone curb 48c., resetting stone curb 30c., pitch filling 15c., sand filling 2c.; John Mazza, 1st st., excavating 37c., paving \$1.15 to \$1.37, pitch filling 15c., sand filling 2c., cement curb 58c. to 73c., stone curb 50c.; Brugh ave., 37c. for excavating, \$1.17 to \$1.39 for paving, 58c. to 75c. for cement curb and 50c. for stone curb.

Knoxville, Tenn.—Street improvements: Barber Asphalt Co., asphalt paving 6 in. base, \$1.88 per sq. yd.; excavation, 57c.; solid rock, \$3, and \$1.78 on 5 in. base; R. S. Blome Co., granitoid paving on all districts, \$1.88 sq. yd.; excavation, 47c.; Cresson Wood Block Paving Co., \$2.54 on 5 in. base and \$2.66 on 6 in. base; excavation, 53c.; Graves-Matthews Paving Co. of Birmingham bid only on Central st., brick paving, pitcher filler, 5 in. base, 2.18, 6 in. base, \$2.24; excavation, 70c.; Mann Construction Co., of Knoxville, on same grade of brick as the Birmingham firm, pitch filler, 5 in. base, \$2.17 per sq. yd., 6 in. base, \$2.22; macadam with tar or oil binder, \$1.16 per sq. yd.; excavation, 61c.

SEWERAGE

Lindsay, Cal.—Citizens will vote June 28 on \$75,000 bonds for acquisition of outfall sewer system.

Athens, Ga.—Citizens will vote July 11 on \$200,000 bonds to erect jail and court house.

Barnesville, Ga.—Surveys are being made by M. B. McCrary & Co., Atlanta, preparatory to extending sewer system.

Thomaston, Ga.—Bids will be received June 15 for \$45,000 sewerage and water works bonds.—R. E. Rushlin, City Clerk.

Crawfordsville, Ind.—Plans are being prepared by E. R. Warbritton for the construction of about 700 lin. ft. of 8-in. sewer in Market st.—F. B. Robinson, Clerk, Board Public Works.

Council Bluffs, Ia.—Council has decided to construct 10 miles sewer on McPherson ave.—C. J. Duff, City Clerk.

Mulvane, Kan.—Plans have been prepared for construction of sewer system; estimated cost, \$8,000.

Winchester, Ky.—Council has decided to ask for bids for installing sewerage disposal plant.

Morgan City, La.—K. A. Kramer, Magnolia, Miss., will make survey for sewerage and water works system; cost about \$60,000.

Lynn, Mass.—Council has ordered construction of public sewer on Michigan ave.

Malden, Mass.—Street and Water Commission intends this summer to build large section of sewer in section east of Suffolk Square.

St. Paul, Minn.—Board of Public Works has rejected all bids for construction of Goodrich ave. sewer.

Trenton, N. J.—Council has decided to construct sewer in Wayne ave.

Albany, N. Y.—Council has passed ordinance for building sewer in Livingston ave. and Black road.

Ilion, N. Y.—Board of Sewer Commissioners has adopted plans for proposed Morgan st. sewer.

Port Chester, N. Y.—Question of sewer disposal plant will be considered by Committee of 12 citizens appointed by the President, to confer with committee having matter in hand.

Edenton, N. C.—W. J. Berryman, Secretary, sewerage committee, desires correspondence with engineers on sewer construction.

Cincinnati, O.—Council is considering construction of sewers in three streets.

Dayton, O.—Board of Control has decided to reject bids for construction of sewers in vicinity of Bolander ave.

Grants Pass, Ore.—Council is considering plan submitted by City Engineer F. E. Hobson to construct two large reinforced concrete conduits for drainage and sanitary sewer purposes along natural channels of Gilbert Creek on the west, and Skunk Creek on east side of the city, which will serve entire city as sewer mains leading to Rogue River; estimated cost \$150,000.

Grants Pass, Ore.—Bids will be received about July 15 for construction of a 24-in. concrete drainage sewer.—F. C. Hobson, City Engineer.

Lebanon, Pa.—Council has approved specifications for proposed house sewer system as designed by City Engineer Crowell, also specifications for sewage disposal plant as prepared by Engineer Jas. H. Fuertes, of New York.

Ligonier, Pa.—Borough Council has passed a resolution to build sewage disposal plant and pumping station; plans have been prepared by F. H. Shaw, of Lancaster, and bids will be taken in the near future.—I. F. Brant, Clerk.

Reading, Pa.—Council is considering building of storm sewers on Spring and Maple sts.

Mount Pleasant, Tex.—Citizens have voted \$16,000 bonds to install sewerage system; plans will be prepared at once.

Salt Lake City, Utah.—Construction of the proposed sewer outlet canal from the present outlet of the gravity sewer on the sewer farm to the waters of Great Salt Lake has been authorized by Council and Board of Public Works instructed to call for bids on the canal at once; estimated cost, \$18,000.

Petersburg, Va.—Council is considering extension and improvement of sewerage system.

Ronconverte, W. Va.—Citizens have voted \$16,000 bonds to extend sewer and water works systems.

Reedsburg, Wis.—All bids opened May 17 for construction of trunk sewers along Franklin st. sewer district have been rejected; proposed work consists of 1,650 lin. ft. 30-in. pipe, 1,200 lin. ft. 27-in. pipe, 1,410 lin. ft. 18-in. pipe; the trenches varying from 8 to 20 ft. in depth, with 10 manholes and 22 catch-basins.

Cannington, Ont., Can.—Plans are being prepared for drainage system; cost \$3,000.—Cavana & Watson, Oullia, Engineer.

CONTRACTS AWARDED

Frederick, Md.—To Bond & Bates, Baltimore, to construct one section of storm sewers, including catch basins and manholes, \$4,892.12.—E. C. Crum, City Engineer.

Malden, Mass.—Furnishing quantity of sewer pipe, to D. W. Lewis & Co.

St. Paul, Minn.—Sewer contracts: Eaton ave., from Indiana to Fairfield, to P. J. Ryan, \$337; St. Clair st., from Macalester to Snelling, to Christ Johnson, \$1,486; Hathaway st., from 7th to Adrian, to C. A. Nelson, \$1,210; Front st., from Western ave. to Mackubin st., to P. J. Ryan, \$1,555; Jessie st., from Whiteall to York st., to O'Neil & Preston, \$1,029.

St. Joseph, Mo.—Constructing 5th ave. main sewer to D. B. Kelly, about \$7,000.

Perth Amboy, N. J.—Laying sewers in Jeffries and Johnstone sts., to Martin Hansen, \$2,080.

Fargo, N. D.—Building sewer on 15th st. North, to Gilbert W. Haggart, \$1.28 per lin. ft., \$57 for manholes and \$59 for catch basins.

Chester, Pa.—Building sewers, to Pritchard & Oliver, Crosby st.: 15 in. terra cotta, \$1.23; Y's, 75c.; manholes, \$39; rock, \$4.50; Edwards st., etc., 8 in. terra cotta, 90c.; Y's, 50c.; manholes, \$39; rock, \$4.50; Engle st., 15 in. terra cotta, \$1.24; 8 in. terra cotta, 92c.; 15 in. Y, 75c.; 8 in. Y, 50c.; manholes, \$39; rock, \$4.75; Concord ave., 8 in. terra cotta, 46c.; Y, 50c.; manholes, \$39; rock, \$4.75; to John Hanna's Sons: Esrey st., 8 in. terra cotta, 92c.; Y, 50c.; manholes, \$39; rock, \$4.75; 15th st., 15 in. terra cotta \$1.25; 8 in., 92c.; 15 in. Y, 75c.; 8 in. Y, 50c.; manholes, \$39; rock, \$4.75.

Scranton, Pa.—Constructing sewer on Delaware st., to M. A. Donahue, 94c. per lin. ft.

Seattle, Wash.—Building sewers on 5th ave., N. E., to Nelson & Carlson, \$8,254.50.

Antigo, Wis.—To John Brogan, Green Bay, to construct sewage disposal plant and intercepting sewer, \$19,945; for former and \$19,888 for latter.

Moose Jaw, Sask., Can.—Extension of storm sewer, to Walter Manden, Edmonton, Alta., \$11,000; other bidders: H. G. McVean, Regina, Sask., \$12,950; W. E. Ransome, Moose Jaw, \$8,850; Navin Bros., Moose Jaw, \$11,913; P. Kilkinny, Ltd., Moose Jaw, \$11,148.

Strathcona, Alta., Can.—To Manley Construction Co. for excavations for east end trunk sewer and laterals, \$29,763.08; additional price of \$3.50 per cu. yd. will be paid for any sandstone or bedrock having to be removed; extensions to present water and sewer lines, \$12,085.48.

BIDS RECEIVED

Bellefontaine, O.—Sewage disposal plant: (a) stone, (b) gravel—Theo. W. Hill, Bellefontaine, (a) \$25,707, (b) \$25,282; Logan County Contr. Co., Bellefontaine, (a) \$28,885, (b) \$31,860; Seymour Renick Co., Findlay, (a) \$30,453, (b) \$30,453; U. S. Constr. Co., Columbus, (a) \$31,001, (b) \$31,851; F. G. Deefendorf, Erie, Pa., (a) \$36,164.

WATER SUPPLY

Headland, Ala.—Town has voted \$7,500 bonds to extend and improve water and electric light system.

Baker, Cal.—Bids will be asked for construction of 9 miles of pipeline extension to Marble Creek, which will greatly increase the capacity of Baker water supply.

Lindsay, Cal.—Citizens will vote June 28 on \$55,000 bonds to purchase present privately owned water system or, failing to agree upon price, to construct complete system.

Piedmont, Cal.—Need of more adequate water system is being urged.

Delmar, Del.—Citizens will vote June 17 on establishment of water works.

Milton, Del.—Citizens have voted \$14,000 bonds to build water plant.

Brownsville, Ga.—Bids will be received June 17, \$35,000 for water works extension, \$15,000 electric light plant improvement, \$80,000 street improvement and pavement bonds.—W. J. Russell, City Attorney.

Thomaston, Ga.—Bids will be received June 15 for \$45,000 water works and sewerage bonds.—R. E. Rushlin, City Clerk.

Arthur, Ill.—Citizens will soon vote on \$15,000 bonds for water works.—John Martin, Mayor.

Bloomington, Ill.—City is considering laying of water mains.—Seth Noble, Superintendent of Water Works.

Heyworth, Ill.—Melnish & Broyhill, of Bloomington, are preparing plans for water works; cost about \$13,000.

Moline, Ill.—Extension of water mains on 4th ave. from 34th to 55th sts. is being urged.

Mound City, Ill.—A. J. Dougherty will soon petition Council for franchise for water works and electric light plant.

Tremont, Ill.—Citizens have voted to construct water works.

Lawrence, Kan.—Local water company is considering \$50,000 expenditure for improvements to water system.

Parsons, Kan.—City Engineer J. M. Guiles is preparing plans for installation of pumping plant.

Morgan City, La.—K. A. Kramer, Magnolia, Mass., will make survey for water works and sewerage system; cost about \$60,000.

Roseland, La.—Council is considering sinking of artesian well.

Lewiston, Me.—City is considering extending water works system.—John Jones, City Engineer.

Hubbell, Mich.—Village Council has decided to construct sewer system on Gregory and E sts.—E. X. Gillet, President.

Evelth, Minn.—Council has rejected all bids for proposed water pump.

Kinney, Minn.—Village is considering plans for complete system of water works.

McComb City, Miss.—Council has issued \$15,000 bonds to extend and improve water works system.

Mason, Nev.—Mason Light & Power Co. is considering enlargement of water supply.

Mt. Vernon, N. Y.—Hering & Fuller, New York City, Consulting Engineers, have recommended sinking of a fourth well.

Newburgh, N. Y.—Board of Water Commissioners will at once ask for bids for finishing laying of 30-in. main from Washington Lake to West st.

Salem, N. Y.—Village has granted to Frank A. Hill franchise to install water works system; supply will be taken from Scott Lake.

Beach, N. D.—M. A. Egan, City Aud., writes that bids will be received about July 1 for the construction of water works.—W. Plomason, Beach, Engineer.

Cleveland, O.—Bids will be received June 19, noon, for \$400,000 water bonds.—H. L. Davis, City Treasurer.

Sandusky, O.—State Board of Health has ordered enlargement of city water filtration plant.

Spencerville, O.—Village Council has selected A. L. Metheany, Lima, to prepare plans for water works.

Toledo, O.—Service Director Cowell will prepare and submit plans to Council for power station for the new high pressure water system fire service.

Urbana, O.—Council has passed ordinance providing \$25,000 bond issue for water works improvements.

Sapulpa, Okla.—Burns & McDonnell, of Kansas City, Mo., will prepare plans and supervise the construction of flow line and reservoir, from deep wells on Euclee Creek.

Weleetka, Okla.—Bids will be received about July 1 for constructing water works and electric plant.—W. M. Bell, Chmn. Water and Light Commission.

Gladstone, Ore.—Council is considering \$20,000 bond issue for water works system.

Wallowa, Ore.—Council has decided to extend water system.

Erie, Pa.—Citizens are considering installation of filtration apparatus.

Mount Penn, Pa.—Surveys are being made and specifications are being prepared for construction of a new 3,000,000-gal. reservoir for Mount Penn Suburban Water Co.—H. S. Hinnershitz, Superintendent.

Mt. Pleasant, Utah.—Council is considering doubling of water supply and installation of electric power plant.

Williamsburg, Va.—George P. Coleman is interested in plan to construct water works to supply vicinity of Court and Palace Greens.

Kirkland, Wash.—Town is considering granting of a franchise to private company for water works.—J. S. Courtwright, Clerk.

Ronceverte, W. Va.—Citizens have voted \$16,000 bonds to extend water and sewer systems.

Cordston, Alta., Can.—Citizens will vote early in July on installation of gravity water system.—R. E. MacArthur, Lethbridge, Engineer.

Olds, Alta., Can.—City proposes to construct water works at cost of \$30,000; engineer not yet selected.—R. L. Earl, City Secretary.

South Vancouver, B. C., Can.—City will purchase 10,000 ft. of 1 in. pipe, two No. 1 mustar tapping machines and two pressure gauges.

CONTRACTS AWARDED

Blytheville, Ark.—By Blytheville Water Co. to United Well Work, Stuttgart, to sink 1,500 ft. artesian well.

San Francisco, Cal.—Furnishing 180 tons of pig lead to Selby Smelting & Lead Co., \$94.20 per ton.

Dolores, Colo.—Building gravity water works system; 8 in. wood pipe supply line, 6 in. and 4 in. and 6 in. Mathewson steel distributing line to Geo. H. Sethman, 250 Equitable Bldg., Denver, \$45,000.

Ayer, Mass.—To the Hodge Boiler Works, 72 Mason Bldg., Boston, for erection of a steel standpipe, 45 ft. diameter and 50 ft. high, to contain 600,000 gal.—Lewis D. Thorpe, Boston, Engineer.

South Hadley, Mass.—To John E. Plumer, 1012 Old South Bldg., Boston, for building steel standpipe, 35 ft. diameter and 60 ft. high; two 250-gal. per minute Deane triplex power pumps are to be installed, and 6 miles of 6 in. to 12 in. pipes are to be laid; total cost of the work will be \$60,000.—Lewis D. Thorpe, Boston, Designing Engineer.

Dodge, Center, Minn.—To Des Moines Bridge & Iron Works, Des Moines, Ia., to install water works, \$18,318.

Lake City, Minn.—Laying water pipes, hydrants, to Fraser & Danforth, Rochester, Minn.

Holyoke, Mass.—Construction of dam at Southampton for Holyoke Water Works: (A) Connecticut Engineering & Contracting Co., Norwich, Conn., \$33,361, awarded contract; (B) J. E. Bunting & Co., Fushing, L. I., N. Y., \$62,120; (C) Lynch Bros., Holyoke, \$56,650; (D) A. O. Bullard, Greenfield, \$49,550; (E) P. J. Kennedy, Holyoke, \$55,320; (F) J. H. Ferguson, Dorchester, \$39,868; (G) Bruno & Pettitt, Boston, \$62,550; (H) D. O'Connell & Sons, Holyoke, \$52,060.

	A	B	C	D	E	F	G	H
1,000 yds. earth excavation.....	\$0.50	\$0.90	\$1.50	\$0.90	\$1.00	\$1.00	\$2.00	\$1.25
800 yds. rock excavation.....	3.50	6.00	2.50	2.50	3.00	3.50	4.00	3.00
200 yds. mass concrete, Class A.....	6.00	9.00	9.00	9.00	8.00	7.25	10.00	8.50
200 yds. mass concrete, Class B.....	5.58	9.00	8.50	8.00	8.00	6.50	10.00	10.00
100 yds. mass concrete, Class C.....	6.25	12.00	9.00	10.00	10.00	7.00	12.00	11.00
6,600 yds. cyclopean masonry.....	4.00	7.70	7.25	6.25	7.10	4.85	7.75	6.45
7 tons steel reinforcement.....	60.00	80.00	60.00	.05*	80.00†	.04*	100.00†	80.00
12 tons hauling iron, etc.....	25.00	20.00	40.00	25.00	25.00	4.00†	25.00	40.00

* pound. † ton.

Madelia, Minn.—To Des Moines Bridge & Iron Co., of Des Moines, Ia., for tank, tower and pipe line extension, \$7,598.

Glasgow, Mo.—Improvement of water works: engine, generator and switchboard to Ridgway Dynamo & Engine Co., Ridgway, Pa.; settling basin to Burdick Bros., Glasgow, Mo.; all general contractors' bids rejected on account of being too high; city will install work by force account.

Battle Creek, Neb.—To Inter-Mountain Bridge & Construction Co., Tecumseh, to construct water plant, about \$10,000.—Alamo Engine & Supply Co., Omaha, Engineer.

Emerson, Neb.—Constructing 4,000 ft. water main to Guy E. Smith, of Indianola, Ia., \$4,167.

Newport, N. Y.—Extension of the water system to Newport Construction Co., Newport, universal pipe, \$12,241.

Niagara Falls, N. Y.—Laying water mains in Willow ave. and Robinson court, to W. A. Shepard, \$2,023 and \$842.50.

Schenectady, N. Y.—To Chas. Miller & Son Co., Utica, for 170 tons of c.-i. pipe and specials.

Haines, Ore.—To G. H. Sutherland & Co., Walla Walla, Wash., for installing water system, \$15,478.

Hermiston, Ore.—John T. Whistler, Chamber of Commerce Bldg., Portland, is preparing plans for construction of water works to cost \$25,000.

Clymer, Pa.—Constructing reservoir for the Citizens Water Co., to P. J. McGovern, Indiana, Pa., \$15,000.

Spokane, Wash.—Furnishing 2,000 ft. of 8-in. c.-i. pipe, to Hofius Steel and Equipment Co., \$44 per ton.

Melville, Sask., Can.—Supply of equipment for water works and electric light, to Kilmer, Pullen & Burnham, Toronto, generators, switchboards, exciters, pumps, motors and compressors installed complete, \$7,438; to Northern Electric & Mfg. Co., Ltd., Winnipeg, street lighting system, \$832; Northern Electric & Mfg. Co., Ltd., Winnipeg, poles and line material, \$2,947; to Wm. Bros. & Sons, Minneapolis, two compression tanks, \$2,018; to Stanley Brock & Co., Toronto, cast-iron mains, \$37 per cwt.; to Stanley Brock & Co., Toronto, special castings, \$60.80 per cwt.

BIDS RECEIVED

Yonkers, N. Y.—Furnishing (a) pipe per ton, (b) castings per ton, (c) valves, per valve: Wood & Co., (a) \$21.79, (b) \$47.50, (c) \$160; Standard Co., (a) \$21.35, (b) \$47.50; Standard Co., (a) \$21.35, (b) \$47.50; United States Co., (a) \$22.20, \$21.50, \$25, (b) \$50, \$45, \$60, (c) \$180; Eddy Valve Co., (c) \$160; John Fox Co., (a) \$22.95, (b) \$49.50, (c) \$223; Kennedy Valve Co., (c) \$149.75; Rensselaer Co., total, \$744.

LIGHTING AND POWER

Ashville, Ala.—Alabama Power & Light Co. has been incorporated to supply nine counties and 20 towns with electric light.

Headland, Ala.—Town has voted \$7,500 bonds to extend and improve electric light plant and water works.

Bakersfield, Cal.—Engineer H. E. Stone, Pacific Bldg., San Francisco, has prepared preliminary plans for hydro-electric project to develop electric power for Kern County Water Power Co.; work will include the erection of large concrete dam and other work.

Fairmont, Cal.—Council is considering \$200,000 bond issue for city improvements including the construction of a dam, certain tunnels and hydraulic work, in San Transquito Canyon, with suitable power house and service lines to substations.

Tulare, Cal.—Tulare County Power Co. has made application for franchise to establish and maintain poles, wires and other electrical appliances in city.—C. H. Holly, Manager.

Bridgeport, Conn.—Mayor Buckingham has recommended installation of municipal lighting and power plant.

Elsmere, Del.—Commissioners of Elsmere have granted to Wilmington Gas Co. right to lay their mains and services along the streets, alleys, avenues and highways.

New York, N. Y.—Contract 67, for construction of portion of the city tunnel of the Catskill Aqueduct, a circular tunnel in rock, 12 ft. and 11 ft. inside diam.; from the northerly end of the work in Union Square at 14th st., tunnel line extends in general southerly direction through Borough of Manhattan, under Fourth ave., Bowery, Delancy, Allen, Hester and Clinton sts., thence beneath the East River to foot of Bridge st., in Borough of Brooklyn, and through this Borough under Bridge st. and Flatbush ave. to terminal shaft, Shaft 23, at Third ave. and Schermerhorn st., and from Flatbush ave. under Lafayette st. to the terminal shaft, Shaft 24, in Fort Greene Park; work will be carried on through six shafts, spaced from 3,800 to 5,200 ft. apart, and varying in depth from 310 to 740 ft.; bidders were: (A) United Engineering & Constructing Co., 17 W. 42nd st.; (B) Holbrook, Caboth & Rollins Corporation, Park ave.; (C) J. F. Cogan Contracting Co., 280 Broadway; (D) T. A. Gillespie Co., 50 Church st.; (E) Winston & Co. and Breuchand & Rogers, City; (F) McArthur Bros. Co., Pine st.; (G) Bradley Contr. Co., 1 Madison ave.; (H) Degnon Contracting Co., 60 Wall st.

	A.	B.	C.	D.	E.	F.	G.	H.
Removing buildings (lump sum).....	\$1.00	\$5,000.00	\$10,000.00	\$5,000.00	\$2,500.00	\$25,000.00	\$25,000.00	\$25,000.00
42 lin. ft. excavation of shaft 19, in earth....	350.00	466.00	425.00	1,500.00	500.00	1,150.00	941.85	300.00
95 lin. ft. excavation of shaft 20, in earth....	450.00	471.00	450.00	750.00	500.00	510.00	941.85	500.00
35 lin. ft. excavation of shaft 21, in earth....	1,000.00	1,082.00	620.00	2,500.00	500.00	2,200.00	941.85	1,200.00
93 lin. ft. excavation of shaft 22, in earth....	440.00	456.00	440.00	750.00	500.00	535.00	941.85	500.00
120 lin. ft. excavation of shaft 23, in earth....	750.00	735.00	495.00	750.00	500.00	535.00	941.85	700.00
100 lin. ft. excavation of shaft 24, in earth....	650.00	614.00	485.00	750.00	500.00	530.00	941.85	400.00
1,500 lin. ft. excavation shafts 19, 20 & 22, rock	350.00	354.00	555.00	475.00	500.00	400.00	445.17	400.00
705 lin. ft. excavation of shaft 21, in rock....	400.00	426.00	620.00	500.00	500.00	800.00	445.17	400.00
215 lin. ft. excavation upper portions shafts								
23 and 24, rock....	350.00	423.00	565.00	500.00	400.00	650.00	445.17	400.00
150 lin. ft. excavation lower portions shafts								
23 and 24, rock....	360.00	393.00	580.00	500.00	500.00	700.00	445.17	400.00
157,000 cu. yds. excavation of tunnels and drifts..	10.20	10.70	11.00	12.00	12.90	13.50	13.00	16.00
1,500 sq. yds. additional trimming in shafts,								
tunnels and drifts.....	3.00	4.00	5.00	14.00	3.00	8.00	6.00	3.00
1,600,000 lbs. furnishing structural steel roof support	.04	.04	.04	.04	.05	.04	.03	.04
1,600,000 lbs. erecting structural steel roof support	.01	.02½	.03	.03	.04	.03	.01	.02
290 M. ft. B. M. temporary timbering.....	50.00	70.00	45.00	100.00	80.00	80.00	75.00	70.00
500,000 million ft. gals., pumping from shafts and								
tunnels during construction.....	.40	.35	.30	.30	1.25	.80	.40	.50
24,350 lin. ft. of drainage shafts, tunnels and								
drifts.....	8.00	2.50	2.00	2.00	2.00	2.00	1.30	4.00
2,900 lin. ft. of forms for outer lining of all shafts	10.00	7.50	10.00	10.00	5.00	10.00	10.00	4.00
730 lin. ft. of forms for inner lining of all shafts	4.00	8.75	8.00	10.00	5.00	10.00	10.00	4.00
2,350 lin. ft. of forms for lining risers.....	2.00	2.00	5.00	10.00	5.00	5.00	10.00	1.20
21,320 lin. ft. of tunnels and drifts.....	10.00	3.75	3.00	4.00	5.00	4.25	4.00	5.00
26,000 cu. yds. concrete masonry in shafts.....	9.00	10.85	9.50	15.00	11.50	10.00	10.00	10.00
70,000 cu. yds. concrete masonry in tunnels and								
drifts.....	11.00	10.25	8.00	10.00	11.50	10.00	10.00	12.00
2,000 cu. yds. excess concrete masonry in shafts								
tunnels and drifts.....	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
200 cu. yds. brick masonry in shafts, tunnels								
and drifts.....	15.00	20.00	15.00	15.00	20.00	20.00	25.00	16.00
6,500 cu. yds. dry packing in tunnels and drift..	2.00	2.50	2.50	2.50	3.00	6.00	4.00	3.00
36,500 sq. ft. drain, interlining in drain shaft....	.25	.25	.15	.30	.40	.50	1.00	.30
820,000 lbs. steel interlining in risers.....	.08	.07	.05	.10	.07	.15	.06	.08
70,000 lbs. steel interlining in and adjacent to								
drainage drift.....	.10	.08	.05	.10	.07	.18	.06	.08
475 sq. ft. cutting channels for water stops.....	1.50	2.50	1.50	3.00	2.00	2.00	6.00	3.40
1,000 lin. ft. drill, 1½-in. holes rock or masonry	.40	1.00	.50	.30	.50	.55	.50	.40
3,000 lin. ft. drill, 1¼ to 2¼-in. holes rock or								
masonry.....	.50	2.50	.75	.40	.60	.65	.50	.50
40,000 lin. ft. steel pipe for grouting.....	.25	.50	.20	.30	.30	.30	.25	.25
Plant and equipment for grouting (lump sum).....	5,000.00	5,000.00	10,000.00	8,000.00	7,500.00	7,500.00	5,000.00	5,000.00
10 high pressure air compressors for grouting	250.00	300.00	500.00	250.00	600.00	300.00	500.00	250.00
5 air-stirring grouting machines.....	350.00	300.00	500.00	350.00	300.00	300.00	500.00	250.00
5 mechanically stirring grouting machines.....	500.00	350.00	500.00	500.00	600.00	600.00	500.00	400.00
40 grouting pads.....	60.00	100.00	80.00	100.00	75.00	75.00	100.00	50.00
8,000 grouting connections.....	2.00	1.50	1.00	3.00	2.00	1.00	1.00	.60
2,500 settings, grouting pads.....	1.00	1.50	2.00	6.00	2.00	1.00	1.00	1.50
4,000 tons sand for grout.....	2.25	2.00	2.00	3.00	5.00	4.00	2.25	1.50
6,000 cu. yds. mixing and placing grout.....	4.00	6.00	5.00	9.00	5.00	5.00	5.00	4.50
11,500 cu. yds. excavation in open cut.....	3.00	3.50	6.00	4.00	3.00	7.00	6.00	3.00
4,800 cu. yds. refilling and embanking.....	1.00	1.00	1.00	4.00	1.50	1.75	.50	.60
250 M. ft. B. M. timber and lumber.....	50.00	75.00	45.00	75.00	75.00	75.00	75.00	50.00
3,200 cu. yds. concrete masonry in open cut..	7.00	12.00	10.00	15.00	12.00	8.00	10.00	10.00
205,000 bbls. Portland cement.....	1.34	1.50	1.50	2.00	1.70	1.50	1.60	1.90
1,000,000 lbs. reinforcing steel.....	.04	.04½	.04	.06	.05	.06	.04	.05
450,000 lbs. miscellaneous iron and steel.....	.06	.07	.07	.10	.07	.10	.05	.07
45,000 lbs. galvanizing.....	.04	.06	.03	.03	.03	.05	.02	.02
930,000 lbs. setting metal work turn, by the city..	.02½	.06	.03	.07	.03	.03	.03	.07
100 tons c. l. pipe and specials.....	100.00	80.00	60.00	100.00	60.00	100.00	100.00	60.00
5,000 lbs. bronze pipe and misc. bronze.....	1.00	.80	1.00	1.00	.60	.75	1.00	.75
500 lin. ft. vitrified pipe, 18 to 24-in.....	.60	2.50	2.00	1.50	1.70	3.00	3.00	1.50
1,200 lin. ft. vitrified pipe, 15-in. and smaller..	.45	1.25	1.25	1.00	1.00	2.00	2.00	1.25
100 cu. yds. rubble masonry and paving.....	3.00	5.00	4.00	6.00	4.50	8.00	6.00	4.00
100 cu. yds. rubble mas. and pav. in mortar.....	5.00	6.00	5.00	6.50	4.50	10.00	9.00	5.00
5,500 sq. yds. pavement.....	3.00	3.00	3.00	4.00	3.50	4.00	4.50	4.00
500 cu. yds. crushed stone and gravel.....	2.50	3.00	2.00	3.00	2.00	2.50	2.00	2.00
50 lin. ft. reinforced-concrete ladders.....	5.00	2.00	3.50	12.00	5.00	5.00	15.00	1.00
Section and locker houses (lump sum).....	20,000.00	8,000.00	10,000.00	20,000.00	15,000.00	20,000.00	18,000.00	1,000.00
8,000 lin. ft. sinking casing and core drilling....	5.00	5.00	5.00	6.00	5.00	6.00	7.00	5.00
5,000 lbs. casing left in place.....	.10	.06	.10	.07	.01	.07	.30	.03
Totals.....	\$5,295,219	\$5,272,435	\$5,469,308	\$6,281,455	\$6,478,450	\$6,572,515	\$5,976,921	\$6,417,385

Construction of four sections of the deep pressure tunnel that is to carry the Catskill water from Yonkers under Manhattan to Brooklyn; first section, which runs from the city line at Yonkers to Burnside ave., near University Heights; Mason & Hanger Co., of Cornwall, \$3,709,372; Grant-Smith Co. & Locher, \$3,775,552; Keystone State Construction Co., \$3,782,760; Pittsburg Contracting Co., \$3,999,380; The T. A. Gillespie Co., \$4,403,540; S. Pearson & Son, Inc., \$4,433,024; Bradley Contracting Co., \$4,546,051; Metropolitan Contracting Co., \$4,627,360; Degnon Contracting Co., \$4,639,710; second section, which runs to Central Park West and 97th st.; Pittsburg Contracting Co., of Pittsburg, \$5,590,225; Patrick McGovern, \$5,775,392.50; Bradley Contracting Co., \$6,798,819.15; The T. A. Gillespie Co., \$6,822,100; Degnon Contracting Co., \$6,872,255; to carry the tunnel from 97th st. to Union Square; Grant-Smith Co. & Locher, of Rome, \$4,512,605; United Engineering & Contracting Co., \$4,719,925; Degnon Contracting Co., \$4,961,645; Bradley Contracting Co., \$5,028,686.30; The T. A. Gillespie Co., \$5,550,005.

Mound City, Ill.—A. J. Dougherty will soon ask for franchise for electric light and water works plant.

Quincy, Ill.—H. O. Channon, Local Manager of the Quincy Gas, Electric & Heating Co., has formally accepted franchise ordinance granted company by Council.—J. T. Lynn, President.

Blanchard, Ia.—Frank Walkinshaw is planning to install electric light plant.

Dallas Center, Ia.—Franchise for the installation of lighting system has been granted to the Adel Mill Co.

Kansas City, Kan.—City has sold \$350,000 bonds for municipal electric plant to Commerce Trust Co.

Lafayette, La.—Plans and specifications have been prepared and bids asked for complete renovation of electric light plant, including change of system from alternating to direct current; cost about \$40,000. Address Superintendent Eyres.

Mansfield, La.—Snider & McCormack, who control gas wells near Naborton, seven miles east of Mansfield, have asked for franchise to supply town with natural gas.

Roseland, La.—Council will consider installation of electric lights.

Federalburg, Md.—South Delaware Gas Co., Seaford, Del., is considering extending gaspipe line from Seaford to Federalburg.

Newberry, Mich.—Citizens have defeated proposition to issue \$11,000 bonds for building power house.

Sebewaing, Mich.—Citizens have voted to construct municipal electric light plant.

Excelsior, Minn.—Franchise has been granted to Belle Plaine Electric Light & Power Co.; electric light plant is to be built at cost of \$12,000.

Minneapolis, Minn.—Minneapolis, St. Paul, Rochester & Dubuque Traction Co. will build \$100,000 power house on 26th st.,

South Minneapolis.—F. C. L. Hunt, Chief Engineer.

Olivia, Minn.—Montevideo Co. proposes to supply electric light to Olivia, Renville and Danube from its plant at Minnesota Falls.

Princeton, Minn.—Village Council has granted franchise to the Eastern Minnesota Power Co. to install and maintain an electric light plant.

Winona, Minn.—Minnesota-Wisconsin Power Co. has been granted permission to build power system through certain streets.

Belton, Mo.—Newman & Homan, Belton, are interested in proposed construction of electric light plant.

Whippany, N. J.—Request for fifty-year franchise to open streets to lay mains was made to Hanover Township Committee by L. D. Howard Gilmour, representing the Public Service Gas Co.

Fulton, N. Y.—Fulton County Gas & Electric Co. has been authorized by the Public Service Commission to issue \$92,000 notes for improvements and extensions.

Smithtown, L. I., N. Y.—Town Board has granted to Long Island Lighting Co. franchise to construct plants and transmission lines and operate same in furnishing current throughout town.

Columbus, O.—J. W. Thomas, of architectural firm of Howell & Thomas, Colonial Savings and Trust Bldg., has been awarded prize for best design for cluster light, 900 of which are to be erected in place of the arches. Jesse Schutte, J. Upton Gribben and B. W. Warden were next in order; design is in form of Greek cross.

Elmore, O.—Citizens have voted \$5,000 bonds to install electric lighting system; plan is to erect poles and wires only and purchase current, bids for which will be asked.

Myrtle Creek, Ore.—Citizens will vote June 29 on \$18,000 bonds to purchase, extend and repair the present water, light and power plant now being operated by Myrtle Creek Water, Light and Milling Co.

College Hill, Pa.—Beaver County Electric Light & Power Co. has purchased municipal electric plant; will dismantle and citizens will be furnished with light from Fallston plant.

Downington, Pa.—Chester Valley Electric Light, Heat & Power Co. is considering construction of a power house; cost about \$75,000.

Mt. Pleasant, Utah.—Council is considering installation of electric power plant and doubling of water supply.

Danville, Va.—City will vote July 11 on \$150,000 bonds for improvement of electric light plant.

Coulee City, Wash.—Council has passed ordinance granting Pacific Power & Light Co. right to construct electric light and power lines.

Vancouver, Wash.—Fire has totally destroyed Vancouver power plant of Portland Railway Light and Power Co., causing loss of \$65,000.

Arcadia, Wis.—Village Board has accepted plans by Vaughn & Meyer for installation of proposed electric light system.

Fond du Lac, Wis.—Eastern Wisconsin Railway & Light Co. has prepared plans and specifications relative to removal of poles and wires from Main st.

Galt, Ont., Can.—City Light Department will expend \$25,000 for the extension of hydroelectric system.

Hamilton, Ont., Can.—Citizens will soon vote on \$500,000 by-law to provide power and light distribution plant.

Moose Jaw, Sask., Can.—Citizens have passed \$7,500 by-law for ornamental lights and \$35,000 for electric light system.

Prince Rupert, B. C., Can.—The Prince Rupert Hydro-electric Co. has acquired control of Tsimpsaan Light & Power Co. and the water rights on Kheda River and Falls River; company will develop 1,500 hp.—C. H. Cahan, K. C., Montreal, President.

CONTRACTS AWARDED

Montgomery, Ala.—By Richard Tillis for brick work of electric light plant which he is erecting in North Montgomery, to James Hodgson, city, \$24,500.

Anaheim, Cal.—Installation of one compound automatic steam engine, one 150-kw., 2,200-volts, three-phase, 60-cycle alternating generator, one exciter, one generator switchboard panel, building foundation and erecting engine and generator to Pacific Coast Mfg. Co., \$7,575; other bidders were as follows: Smith Booth-Usher Co., \$7,488; Ridgway Dynamo Engine Co., \$7,680; B. F. Kierulff, Jr., Co., \$7,135; Machinery Electrical Co., \$7,311; Allis-Chalmers Co., \$7,345; J. F. Cornel, \$6,730; F. C. Roberts & Co., \$7,818, and Charles C. Moore & Co., \$7,575.

Newark, Del.—Furnishing power to electric plant to Elk River Light & Power Co. **Hillsdale, Mich.**—To the Allis-Chalmers Co., Milwaukee, Wis., for 300-kw. direct-connected steam turbine and a generator for \$9,900.

Talihin, Okla.—By Talihin Light & Power Co. contract to Mullergren Engineering Co., Poteau, to construct an electric light plant including 50-hp. boiler, 30-kw. three-phase, 2,300-volt generator and 40-h.p. high-speed engine.

Richmond, Va.—Ornamental lighting on West Broad st. and Jefferson ave., to the Gordon Supply Company for thirty-three posts for West Broad st., and to J. L. Mott Iron Works for thirty-one posts on Jefferson ave.; to Gordon Supply Company for lamps and globes, and to I. J. Smith & Company for Broad st. conduits and underground connections.

Madison, Wis.—By Peninsula Power Co. for construction of a dam, water power, equipment, etc., at Twin Falls, on the

Menominee River, to Newton Engineering Co., 1202 Majestic Bldg., Milwaukee, \$750,000.—Prof. D. W. Mead, Chief Engineer.

BIDS RECEIVED

Fort Morgan, Ala.—Furnishing pump, switch-panel transformer, transmission line, and 4 in. water main: A. M. Lockett Co., Ltd., New Orleans, La., \$6,900. Newport Contracting & Engineering Co., Newport News, Va., \$6,014. Mobile Electrical Supply Co., Mobile, Ala., \$6,108. Anderson Martin Electric Co., New York, \$5,474. W. C. Pease, Mobile, \$4,640.

Muskegon, Mich.—Muskegon Traction & Lighting Co. of this city has offered to furnish street lights at \$55 a year; franchise just expired provided for \$76 per arc light.

FIRE EQUIPMENT

Bridgeport, Conn.—Mayor Buckingham has recommended permanent fire department, erection of fireproof building for fire alarm telegraph system and extension of fire alarm system.

Thompsonville, Conn.—Fire Chief W. J. Hines has recommended installation of number of fire alarm boxes and hydrants and purchase of 50-h.p. auto truck or equipment of hook and ladder truck with motor power.

Ottawa, Kan.—Purchase of auto fire apparatus is being considered.

Maysville, Ky.—Fire Committee has been instructed to install Gamewell fire alarm system at cost of \$2,100.

New Orleans, La.—City has decided to erect No. 52 engine house on Clayton ave. at cost of \$16,000.

Lawrence, Mass.—Purchase of auto combination wagon is being considered. Address Chief Carey.

Lawrence, Mass.—Fire Chief D. E. Carey will purchase 2,000 ft. of hose.

Malden, Mass.—Finance Committee is considering \$1,000 appropriation to purchase auto runabout for Fire Chief Frank Turner.

Quincy, Mass.—City has awarded \$22,525 fire department and street bonds to Curtis & Sanger.

Watertown, Mass.—Town will erect fire station.

Port Huron, Mich.—Bids have been ordered advertised for furnishing 600 ft. of fire hose.

Eveleth, Minn.—All bids have been rejected for erection of fire hall and public library.

Kansas City, Mo.—Fire Chief John C. Egner has recommended purchase of 4,000 ft. of fire hose.

Milwaukie, N. J.—Council has decided to purchase auto chemical hook and ladder truck.

Perth Amboy, N. J.—Fire Chief Patrick Rocks has recommended purchase of 20,000 ft. of new hose.

Addison, N. Y.—Welles Hose Co. will purchase chemical.—Edw. L. Hill, Chief.

Albany, N. Y.—Council has passed ordinance appropriating \$4,000 for repairing and rebuilding of old Truck No. 2.

Gorham, N. Y.—Citizens are considering purchase of fire engine.

Poughkeepsie, N. Y.—Young America Hose Co. is urging purchase of auto engine. L. A. Thomson is interested.

Sauquoit, N. Y.—Town has voted \$500 for fire purposes.

Bellaire, O.—Need of additional fire hose is being urged.

Cleveland, O.—Bids will be received June 19, noon, for \$25,000 fire department coupon bonds.—H. L. Davis, City Treasurer.

Youngstown, O.—Council will consider \$45,000 bond issue for purchase of four auto trucks.

Youngstown, O.—Committee of Volunteer Fire Department of East Youngstown will recommend to Council that suits and fire engine be purchased and temporary fire house be appropriated for use of members.

New Carlisle, O.—Town is considering purchase of fire engine.—C. B. Meredith, Chief.

Grants Pass, Ore.—Council has called election June 29 on purchase of automobile, combined pumping and chemical fire apparatus.

Dunmore, Pa.—Council has decided to erect two fire houses.

Woonsocket, R. I.—Fire Department Committee, Councilman F. X. Berard, Chairman, is inspecting auto apparatus with view to purchase; \$5,000 Pope-Hartford combination ladder, chemical and hose auto is favored.

Huntington, W. Va.—Fire Commissioners have asked for bids for auto fire patrol.

CONTRACTS AWARDED

Bridgeport, Conn.—Furnishing two combination auto chemical engines and hose wagons, cost \$6,000 each, to Locomobile

Co. of America; steam fire engine, auto chassis, to Nott Fire Engine Co., Minneapolis, \$10,000.

Englewood, N. J.—To American-La France Engine Co. for \$7,500 motor-driven fire engine.

Beaver Falls, Pa.—Furnishing fire hose to Eureka Hose Co., 500 ft. Paragon hose; to Continental Rubber Co., 200 ft.; to Quaker City Rubber Co., 250 ft. Pompitic hose.

Wilkes Barre, Pa.—To Eureka Fire Hose Co. for 500 ft. of hose, and to Gutta Percha Co. for 300 ft.

BRIDGES

San Diego, Cal.—Plans are being prepared for 4-span reinforced concrete bridge to cross East st. at 17th st.; bridge will have a roadway 35 ft. wide; estimated cost is \$5,000.

Willows, Cal.—Glenn County is considering \$200,000 bond issue to build bridges and roads.

Bridgeport, Conn.—City Engineer M. M. McKenna, has about completed plans for Island Brook bridge to be of reinforced concrete, with a span of 22 ft.

Live Oak, Fla.—County Commissioners will let contract in July for erection of bridge across Suwannee River at Noble's Ferry.

Darien, Ga.—McIntosh and Glynn County Commissioners will consider construction of bridge across Altamaha River, Engineer C. S. Davis, Chicago, Ill., has estimated cost at \$80,000.—H. F. Dunwoody, Brunswick, Chairman Committee.

Duluth, Minn.—County Commissioners have decided to ask for bids for erection of bridge over Little Fork River on Wakely road.

Hackensack, N. J.—Board of Freeholders has authorized erection of bridge over Passaic River on Belleville turnpike.

Trenton, N. J.—Board of Freeholders will ask new bids for building two culverts on Pennington and Harborton roads.

Lowville, N. Y.—Town has voted \$9,000 bonds to erect concrete arch and culvert over Mill Creek.

Port Chester, N. Y.—Plans and specifications have been completed for widening Byram Bridge; work will soon begin.

Whitesboro, N. Y.—Town will vote June 30 on \$7,000 bonds to build bridge across Sauquoit Creek.

Wilmington, N. C.—New Hanover County has voted \$50,000 bonds for bridge and road construction and improvement.—D. McEachern, Chairman, County Commissioners.

Cincinnati, O.—Board of County Commissioners has approved plans and specifications for concrete bridge at the intersection of German and Compton sts. at estimate of \$2,444.

Cleveland, O.—Bids will be received June 19, noon, for \$300,000 bridge coupon bonds.—H. L. Davis, City Treasurer.

Gatesville, Okla.—Gatesville Township, Wagoner County, has voted \$7,500 bridge bonds.

Kutztown, Pa.—Berks County Commissioners will erect concrete bridge over Saucony River.

McElhattan, Pa.—Clinton County Commissioners, Lock Haven, have rejected all bids for proposed bridge over west branch of the Susquehanna River at McElhattan; Farris Eng. Co., Jenkins Arcade Bldg., Pittsburg, will revise plans; new bids will be received early in July.

Roxbury, Va.—Supervisors of New Kent and Charles City counties have decided to erect bridge over Chickahominy River.

Quebec, Que., Can.—Plan have been prepared by Strauss Bascule Bridge Co., Fort Dearborn Bldg., Chicago, Ill., for 150-ft. single-leaf highway bascule bridge over the St. Charles River.—W. D. Baillarge, City Engineer.

CONTRACTS AWARDED

Live Oak, Fla.—By Board of County Commissioners, for building bridge across Suwannee River at Dowling Park, to Southern Bridge Co., Birmingham, Ala., \$5,000.

Hutchinson, Kan.—Building bridge over Cow Creek on Walnut st. to St. Joseph Construction Co., \$4,531; other bidders: Iola Concrete & Engineering Construction Company, \$6,420 with \$60 allowance; Illinois Steel Bridge Company, \$6,257 with \$60 allowance; Murphy Bros., Las Animas, Colo., \$6,652 with \$60 allowance; Shears & Son, \$5,180 with \$32 allowance; Massillon Bridge & Construction Company, \$5,764; Howard & Everett, \$5,725.

Hackensack, N. J.—Building snow bridge at New Milford, to F. R. Long Co., \$14,862.80.

New York, N. Y.—Strengthening end spans of the Williamsburg bridge, over East River, between the Boroughs of Manhattan and Brooklyn, to the Snare & Triest Co., 143 Liberty st., New York (A)

\$544,540, (B) \$15,000, total, \$559,540; other bidders: North-Eastern Construction Co., 225 5th ave., \$548,400, \$20,000, \$568,400; John Monks & Sons, 82 Beaver st., \$571,000, \$20,000, \$591,000; McClintic-Marshall Construction Co., 1214 Park Bldg., Pittsburg, Pa., \$573,738, \$18,000, \$591,737; Oscar Daniels Co., 38 Park Row, \$587,700, \$12,000, \$599,700; Rodgers & Hagerly, Inc., 41 Park Row, \$605,500, \$10,000, \$615,500; Phoenix Construction Co., 41 Park Row, \$599,897, \$30,000, \$629,897; Terry & Tench Co., Inc., 70 East 45th st., \$666,950, \$10,500, \$677,450; Pennsylvania Steel Co., 71 Broadway, \$719,888, \$17,500, \$737,388; Charles Meads & Co., 165 Broadway, \$767,000, \$20,000, \$787,000. All contractors are of city, unless otherwise noted; (A) lump sum bid, (B) unit price bid per cu. yd. of caisson work below elevation 45 ft., and for purpose of comparison of the bids the number of cu. yds. is taken at 1,000.

Utica, N. Y.—Construction of culvert over Ballou Creek from Mary st. to Blandina st., to Frank M. Johnston, \$3,065; other bidders: Martin McManus, \$4,225; Harry W. Roberts & Co., \$3,325; N. D. Peters & Co., \$3,150; Heverin & Dwyer, \$3,305; Kennedy Roofing and Paving Co., \$3,340.

Charlotte, N. C.—Erecting \$50,000 bridge over Catawba River, to Roanoke Bridge Co., Roanoke, Va.; about 3,000 cu. yd. of concrete will be used for abutments and 700 tons of fabricated steel for frame work.

Springfield, O.—Repairs on Mad River bridge, to J. V. Clayton; same on Elder bridge and New Carlisle bridge, to Home Engineering & Contracting Co., Canton; masonry on Cartwell bridge, to Edward Ervin, Catawba.

Oklahoma City, Okla.—Building fire bridge on new courseway, to the Kansas City Bridge Co.

Purcell, Okla.—Constructing highway bridges over Canadian River, consisting of 18 150ft. double intersection Warren riveted spans, with steel and timber trestle approaches, total length 3,237 ft., to the Central States Bridge Co.—Allen & Gorcia, McCormick Bldg., Chicago, Engineers.

Pittsburg, Pa.—Widening the Smithfield st. Bridge to Ft. Pitt Bridge Co., \$54,160.

Pittsburg, Pa.—Constructing three reinforced concrete bridges; Bridge No. 1, to Foley Bros., \$3,212; Bridge No. 12, to the Reinforced Concrete Construction Co., \$12,293; Bridge No. 13, to R. S. Dickson,

\$11,982.—R. J. Cunningham, County Controller.

Milwaukee, Wis.—Building one-leaf bascule bridge at Oneida st., to Milwaukee Bridge Co., \$92,845.

MISCELLANEOUS

Hamilton, Ala.—Marion County Commissioners will consider erection of jail to replace present building.

Wilmington, Del.—Playground Association is urging establishment of additional playgrounds.

Wilmington, Del.—Police Commissioners have decided to purchase \$2,500 automobile patrol wagon.

Ashville, Fla.—Fitzhugh Lee, County Surveyor of Etowah, has prepared plans and specifications for artificial lake to be about 500 ft. in diameter and located near large spring in town.

Columbus, Ga.—City is considering erection of garbage crematory.

Savannah, Ga.—City is considering expending \$20,000 for improvements to city market.

Freeport, Ill.—Citizens have voted to create park district.

Fort Wayne, Ind.—O. C. Barnett, of Kansas City, Landscape Engineer, representing George Kessler, landscape engineer, who has been retained by the city to develop comprehensive and detailed plan for the improvement of the park and boulevard system will have charge of preliminary field work and will submit his data to Mr. Kessler, who will then design plans.

New Orleans, La.—Plans are being prepared by E. A. Christy, New Orleans, for proposed Dryades Market; cost, \$36,000.

Bath, Me.—Village Trustees have decided to ask for bids for \$30,000 bonds to erect village hall.

Boston, Mass.—Public Grounds and Park Departments will advertise for specific pattern or design of seat or settee which may be either concrete, wood, stone or iron; \$7,000 available for purchase of suitable seats.

Boston, Mass.—Frederic H. Fay, Division Engineer in Charge of Bridges and Ferries, has notified Mayor Fitzgerald that it would cost about \$45,000 to build steamer to take place of health boat Vigilant.

Holyoke, Mass.—Architect W. J. Howes has prepared plans for erection of shelter for playgrounds.

Eveleth, Minn.—All bids have been rejected for erection of public library and fire hall; new bids will be asked.

Meridian, Miss.—Proposed Carnegie library will be erected at 25th and 7th sts.

Newark, N. J.—Architects Harry J. and J. V. King will prepare plans for proposed station for Sixth Precinct.

Albany, N. Y.—Council has passed ordinance providing for establishment of a new police signal system at cost of \$20,000.

Le Roy, N. Y.—Village Trustees and Town Board are considering erection of combined municipal building.

New Rochelle, N. Y.—Council has adopted resolution authorizing bonds to be issued for court house; cost at least \$75,000.

Schenectady, N. Y.—Plans will be prepared at once for erection of proposed jail.—I. L. Whitmyre, Chairman, Jail Committee.

Akron, O.—Health Board has recommended immediate need of garbage disposal plant on pumping ground.

Cleveland, O.—Bids will be received June 19, noon, for \$45,000 park bonds, \$8,000 city farm school bonds, \$10,000 infirmity improvement bonds.—H. L. Davis, City Treasurer.

Columbus, O.—Director of Public Service has decided to readvertise for bids for construction of wagon sheds for Garbage Department.

Toledo, O.—Purchase of six garbage wagons has been recommended by Service Director Cowell.

Grants Pass, Ore.—Citizens will vote June 29 on sale of present city hall and erection of new building.—F. E. Hobson, City Engineer.

York, Pa.—Park Commissioner W. P. Swartz has completed plans for establishment of playgrounds on Farquhar Park.

El Paso, Tex.—Erection of \$10,000 pest house is being considered.

Salt Lake City, Utah.—City stable at Liberty Park has been destroyed by fire.

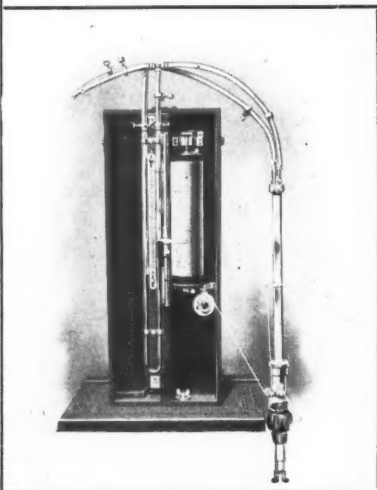
Huntington, W. Va.—City Commissioners will at once ask plans for proposed municipal building.

CONTRACTS AWARDED

Oakland, Cal.—Building city hall: Mason work, to Gladding-McBean Co., \$122,360; structural steel, to Judson Mfg. Co., \$234,376; granite work, to McGilvary-Raymond Granite Co., item b, \$160,000; concrete

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work, to Roebbing Construction Co., \$104,000; granite work, to Raymond Granite Co., item a, \$19,680; architectural terra cotta, to Gladding-McBean Co., \$65,000; roofing and skylights, to Ford & Mallott, \$13,650; metal doors, to Forderer Cornice Works, \$2,970; ornamental iron and bronze, to California Art Met. and W. Works, \$97,700; plastering and imit. stone, to C. C. Morehouse, \$40,750; int. marble and tile, to Jos. Musto Sons-Keenan Co., \$104,993; rough carpentry, to Oliver Duval, \$34,100; cork floors, to David Kennedy, Inc., \$3,293; finished hardware, to Pierce Hardware Co., \$13,440; vaults and vault doors, to Mosler Safe Co., \$9,440; vacuum cleaning, to H. W. Moffatt & Co., \$3,120; electric wiring, to John G. Sutton Co., \$40,000; plumbing, to J. Looney, \$37,627.

Hastings, Fla.—Building cement jail, to S. R. Taylor, Palatka.

Lexington, Ky.—To Home Construction Co. for sweeping and cleaning paved streets.

Utica, N. Y.—Furnishing underground cable to be used in connection with the new

central fire station, to Safety Insulated Wire and Cable Co., New York 20-conductor 29½c., 8-conductor 19½c.; other bidders: Utica Fire Alarm Telegraph Co., 20-conductor 45½c. per ft. for Roebbing brand, 52c. for Okenite brand; for 8-conductor, 22½c. for Roebbing brand, 24½c. for Okenite brand; Standard Underground Cable Co., New York, 20-conductor 43 94-100c., 8-conductor 20 91-100c.

Yonkers, N. Y.—To Contractor Fred E. Gross & Son for construction of playground on Ashburton ave., \$2,250; other bidders: Kelly & Hannifan, \$2,750; Frank Cianfaglione, \$2,900, and Barden Bros., \$2,076, but they did not file sureties; A. G. Spalding & Bros. for playground equipment, \$1,080.

BIDS RECEIVED

Newark, N. J.—Furnishing automobile combination patrol and ambulance, R. M. Owen & Co., for the furnishing Premier make of auto, \$3,800; Detroit Cadillac Motor Car Co., Cadillac car, \$2,750; Pope-

Hartford Co., Pope-Hartford car, \$4,934.80; Greene Motor Car Co., locomobile, \$4,000; the White Motor Co., White gasoline car, \$3,000; Johnston Auto Conveyance Co., Johnston car, \$3,500; Studebaker Brothers Co., Studebaker car, \$2,800; F. L. C. Martin, Alco car, \$4,785, and Mitchell car, \$2,475.

Toledo, O.—Erecting comfort stations in four parks: Schillinger Brothers, \$14,092; Kepitke, \$12,842; C. Hull, \$16,996, and Bright Construction Co., \$11,950; swimming pools in three parks: Schillinger Brothers, \$10,291 and Bright Construction Co., \$11,500.

Portland, Ore.—Temporary jail in seventh story of new east wing of court house: The Pouly Jail Building Co., St. Louis, \$22,500 for cell work, with stipulation that if women's cells were to be made of proof steel price would be increased \$1,400; Stewart Iron Works Co., Cincinnati, offered to install man-cages for \$31,790; installing cell work in west wing, where permanent jail will be located, Pouly Co. bid \$52,340, and Stewart Co. \$106,460.

TOO LATE FOR CLASSIFICATION

BIDS ASKED FOR

STATE	CITY	RECEIVED UNTIL	NATURE OF WORK	ADDRESS INQUIRIES TO
STREET IMPROVEMENTS				
Ohio.....	Akron.....	June 16, 1 p.m.....	Paving various streets.....	John W. Gauthier, Dir. Pub. Serv.
New York.....	Albany.....	June 19, 3 p.m.....	Repaving portion of Maiden Lane.....	Isidore Wachsman, Secy. B. C. & S.
Pennsylvania.....	Etna.....	June 19, 5 p.m.....	Grading and paving Kraus alley.....	J. C. Armstrong, Borough Clerk.
New Jersey.....	Linden.....	June 19, 8 p.m.....	Grading and macadamizing Grier ave., about 3,867 sq. yds. of 6-in. macadam and 3,200 cu. yds. excavation.....	Jacob L. Bauer, Township Engineer.
New York.....	Albany.....	June 19, 3 p.m.....	Repaving portion of Maiden Lane.....	Isidore Wachsman, Secy. B. C. & S.
California.....	Oakland.....	June 19, 5 p.m.....	Grading Vernon st., curbing with concrete and paving with an oil macadam pavement; concrete gutters, drains, etc.....	Frank R. Thompson, City Clerk.
Pennsylvania.....	Philadelphia.....	June 20.....	Repairing asphalt pavement on certain non-traction streets; improvement of streets including repaving 28,805 yds. mac., grading, planting trees, lay. walks, curb., placing iron fence.....	
New Jersey.....	Trenton.....	June 20, 8 p.m.....	Paving various streets with filbertine; paving portion of Second street with sheet asphalt; repaving portion of North Broad street with filbertine on 6-in. concrete base.....	Harry B. Salter, City Clerk.
Washington.....	Spokane.....	June 22, 11 a.m.....	Grading, paving, sidewalk, curbing and parking various streets; estimated cost \$300,000.....	Morton Macartney, City Engineer.
Pennsylvania.....	Pittsburg.....	June 23, noon.....	Furn. 5,000 bbls. of Portland cement during nine months ending March 31, 1912.....	J. R. Cunningham, County Compt.
Ohio.....	Lorain.....	June 27, noon.....	Improving various streets and alleys by paving with macadam, sheet asphalt, block asphalt or vit. brick, with necessary excavation, draining, curbing, foundations, etc.....	L. B. Johnson, Clk. Dept. Pub. Serv.
Arkansas.....	Little Rock.....	June 30.....	Paving about 13,000 sq. yds. with creosoted block; 25,000 sq. yds. of macadam.....	E. A. Kingsley, Engineer.
Georgia.....	Rome.....	July 1, noon.....	Grading, curbing and paving various streets with wood block, vit. brick, hassam, asphalt macadam, sheet asphalt and bitu.	J. R. Cantrell, City Clerk.
Ohio.....	Cincinnati.....	July 7, noon.....	Oiling Harrison pike in Harrison and Whitewater townships; also repairing Indian Hill avenue in Columbia township.....	Stanley Struble, Pres. Bd. Co. Comrs.
Oregon.....	Grants Pass.....	July 6.....	Constructing 30,000 sq. yds. of pavement.....	F. E. Hobson, City Engineer.
SEWERAGE				
Ohio.....	Akron.....	June 16, noon.....	Constr. main sewer in Glendale cemetery; storm and sanitary sewers in various streets.....	John W. Gauthier, Dir. Pub. Service.
Pennsylvania.....	Patton.....	June 19.....	Laying 10,000 ft. of sewers.....	City Clerk.
New Jersey.....	Trenton.....	June 20, 8 p.m.....	Constr. sanitary sewers and house connections in var. streets.....	Harry B. Salter, City Clerk.
New York.....	Binghamton.....	June 28, 4 p.m.....	Laying vit. pipe sewer with necessary manholes, catch basins, flushing tanks, and connections, in Union, Brace and Berlin sts	S. W. Murray, Clk. Bd. C. & Sup.
WATER SUPPLY				
Dist. of Col....	Washington.....	June 20, 2 p.m.....	Furnishing 200 low pressure fire hydrants.....	Cuno H. Rudolph, Comr.
LIGHTING AND POWER				
Minnesota.....	Browns Valley...	June 21, 7:30 p.m....	Installing a municipal light plant, using gas producer power....	L. P. Bigelow, Village Clerk.
BRIDGES				
Kansas.....	Topeka.....	June 19, 10 a.m.....	Reconstructing bridge across Shunganunga Ck. on Filmore st....	C. B. Burge, City Clerk.
FIRE EQUIPMENT				
W. Virginia.....	Charleston.....	June 19.....	Furn. 500 ft. of 2½-in double jacket, rubber lined firehose, Fehy couplings.....	O. A. Petty, Comr. Pub. Safety.
MISCELLANEOUS				
Dist. of Col....	Washington.....	June 20, 2 p.m.....	Furn. 2 motor trucks for use Water Department.....	Cuno H. Rudolph, Commissioner.
New Jersey.....	Jersey City.....	June 20, 8 p.m.....	Constr. a 20-in. cast iron drain at Montgomery Park.....	A. T. Hashings, Jr., Secy. Sh. Tree C.
Pennsylvania.....	Johnstown.....	June 20, 3 p.m.....	Erecting concrete walls along Franklin st. extended.....	Lee Masterton, City Engineer.



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ALL SIZES—ANY STYLE—FOR ANY MACHINE
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STREET IMPROVEMENTS

Vincennes, Ind.—County Commissioners will ask for new bids for building gravel road extension in Vincennes Township.

Crowley, La.—Council has adopted third cement sidewalk ordinance, providing for 16 miles of additional cement sidewalks.

Baltimore, Md.—Plan to cover cobblestones with concrete and asphalt as means of providing improved streets has been decided upon by Mayor Preston, City Engineer Fendall and Chairman Compton of the Paving Commission.

Rockville, Md.—Colesville District has decided to bond district in the amount of \$12,000 for the purchase of eight and one-fourth miles of the Washington, Colesville and Ashton turnpike lying in Colesville district and to improve about mile of the Columbia road, also in Colesville district.

Akron, O.—Council has passed an ordinance to issue \$84,000 bonds for paving of streets and other street improvements in the city.

Cincinnati, O.—Cost of improvement of Cameron road, Sect. 1, Springfield Township, has been estimated at \$8,575 and resurfacing of North Bend road, \$1,654.

Findlay, O.—Council is making arrangements to repave Main st. from Hardin st. to the C. & D. tracks on North Main st.; estimated cost, nearly \$40,000.

Muskogee, Okla.—Council has rejected all bids for paving and will ask new bids on both rock and artificial asphalt.

Grants Pass, Ore.—Plans and specifications have been adopted for two miles of water-bound macadam thirty-foot roadway upon three different streets.—F. E. Hobson.

Greenville, Pa.—Paving of additional streets is being considered.

Seattle, Wash.—County Commissioners will at once ask for bids for construction of permanent highways Nos. 1 and 2.

Seattle, Wash.—Board of Public Works has adopted plans for grading Belvidere Ave., cost \$63,800; paving Twenty-first ave. North, \$142,000; concrete walks on Market St., \$14,400; grading alley in McKenzie & Dempsey's Addition, \$1,115.

Spokane, Wash.—Plans for grading, curbing, sidewalk and parking of Seventeenth ave., Havana to Freya st., and of Seventeenth ave., Freya to Regal, at total estimated cost of \$24,600, have been submitted to Council and recommended for passage by the Department of Public Works.

Walla Walla, Wash.—Council has ordered sidewalk Alder st., \$1,332.36.

CONTRACTS AWARDED

Red Bluff, Cal.—By Board of Supervisors to W. D. Russell, Paskenta, for construction of new Paskenta-Round Valley road; cost, \$62,300.

Lafayette, Ind.—Building gravel roads, Tippecanoe County, to D. H. Fatout, Indianapolis, Bros-Bros road, \$4,816; to E. Coleman, city, Wedener road, \$8,493; to D. H. Fatout, Wolfe road, \$4,276; to Snyder & Barrett, McAfee road, \$4,276; and Steeley road, \$5,997; to Kelleher & Co., Frankford, Riverside road, \$28,785.

Michigan City, Ind.—By County Commissioners to John A. Young, for construction of macadam road in Center and Springfield Township, \$18,420.

Valparaiso, Ind.—By Porter County Commissioners, to W. B. Hutchinson, Michigan City, and Jacob Ackerman, Laporte, for building Pleasant Township gravel road, \$76,500.

Vincennes, Ind.—Gravel road extension in Busserson Township, to H. F. Jones, \$2,900.

Franklinton, La.—To Boyd & Bradshaw, of Columbia, Miss., for the building of about 300 miles of roads, approximating \$75,000.

Boston, Mass.—To C. W. Dolloff & Co., for edgestones, gutters and crosswalks on Melville ave., \$2,955.70; engineer's estimate, \$5,000; to F. S. & A. D. Gore Corporation, for macadam roadway on Chisham st., \$3,504.51; engineer's estimate, \$4,600; to same, for repaving and regulating Dorchester ave., \$4,846; engineer's estimate, \$5,800; to Robert Edger, Jr., for artificial stone sidewalks on Hutchings st., \$978.15; to C. W. Dolloff & Co., for artificial stone sidewalks, edgestones, gutters and crosswalks on Nullet st., \$3,462; to same, River st., \$5,039.31.

Lowell, Mass.—Paving blocks for city, calling for 500,000 paving blocks, to Frank A. Mallory, North Chelmsford.

Brainerd, Minn.—To Ritar Bros. to lay cement paving on Third ave. N. E., \$4½¢ per yd.

Dayton, O.—River st., Ferguson to Iowa, to John White, \$13,169.50; Valley st., Brandt to the Miami and Erie Canal, to Kernan & Co., at \$11,973.60; Valley st., Brandt to Findlay, to Kernan & Co., \$8,826.60; Creighton ave., Wayne to Wyoming, to Kernan & Co., \$14,164.60; Troy st., Leo to Valley, to J. O. Shoup, \$37,518; Phillips ave., Wayne

to Wyoming, to J. E. Conley, \$15,747.50; Broadway, Albany to Bolander, to W. H. Boyd, \$9,643.40; Clover, Wayne to Filmore, to J. E. Conley, \$12,721; Bayard, Ludlow to Perry, to W. H. Boyd, \$24,090; Carrie, Perry to Mead, to W. H. Boyd, \$918.10; Perry, Fifth to the railroad, to W. H. Boyd, \$2,325; first alley west of Wayne, Fifth to Short, to Hoolihan, \$701.80; and the first alley south of Fifth, High to the first alley west of High, to same, \$319.10.

Franklin, Pa.—Paving seven streets, to Northwestern Construction Co., city, with Bessemer block, \$65,136.39, or \$1.23 per sq. yd.

Richmond, Va.—To C. P. Lathrop Co., for furnishing 20,000 bbls. of Old Dominion Portland cement, \$1.71 per bbl.

Milwaukee, Wis.—To the Continental Asphalt and Equipment Co. to provide city with \$3,500 portable asphalt repair plant.

WATER SUPPLY

Haigler, Neb.—Election on bonds for installation of water works is being considered.

Monaca, Pa.—Council has decided to purchase 2,000 ft. of pipe.

Johnston, R. I.—Town Council is considering petition from Stoneleigh Water Company, Graniteville, for franchise to distribute water through northerly end of the town and to lay pipes over or under town highways at various times with permission of Council on each occasion.

Seattle, Wash.—Board of Public Works has adopted plans and specifications for laying water mains on W. 80th st., \$15,700, and for Cedar River water system No. 2.

Walla Walla, Wash.—Franchise for 50 years has been granted the Pacific Power & Light Company for transmission power line from Walla Walla city over county roads to Columbia county line, through Dixie and Waltsburg, and for a spur line from Waltsburg to Prescott.

CONTRACT AWARDED

Boston, Mass.—Furnishing four 30-in. and five 20-in. c.-i. valves for Calf Pasture Pumping Station, to Fairbanks Company, \$423 and \$117.47.

BRIDGES

Sacramento, Cal.—Supervisors have adopted plans and specifications for \$35,000 bridge across American River.

Vacaville, Cal.—Engineer Steiger is preparing plans and specifications for new bridges that are to be built in city.

New Bedford, Mass.—City Engineer Williams has estimated cost of bridge repairs at \$10,979.

Shreveport, La.—City Council and Bossier Parish Police Jury have decided to build the substructure of \$200,000 wagon bridge across Red River and to let contract for superstructure after piers have been built.

CONTRACTS AWARDED

Ft. Wayne, Ind.—By County Commissioners for \$12,179 worth of new bridges, to Ed. H. Gallager, eight contracts; to George Jaap, twelve, and to George Zeimer, George Ehling and the Attica Bridge Company, one each.

Martinsville, Ind.—Construction of five-span concrete bridge across White River at Waverly, by County Commissioners to the National Concrete Company, \$38,750.

Vincennes, Ind.—Building three bridges in county, to Vincennes Bridge Co., \$1,733.

Fort Scott, Kan.—By Joint Boards of County Commissioners of this and Vernon County, Mo., for bridge to be built across Drywood, as joint construction, to Standard Bridge Co., Kansas City, \$25,000.

Springfield, Mass.—Building iron bridge over Canal, to United Construction Co., Albany, N. Y.; abutments, to Jas. H. Thomas.

Marlborough, N. Y.—By Town Board, for steel and concrete bridge, to Samuel Beskin, \$2,987.

Richmond, Va.—Building reinforced arch bridge over Gilie's Creek, to Geo. Donnell, \$9,011.93.

MISCELLANEOUS

Elizabeth, N. J.—Purchase of auto police patrol is being considered.

Beaver Falls, Pa.—Grand Jury has recommended erection of modern jail.

Ashland, Wis.—City Engineer Jerod W. Day has completed plans for the concrete arch to be put in north of Northland College on Ellis ave.

CONTRACTS AWARDED

Dayton, O.—Building retaining wall along Mud River, to Jos. Bailey, \$2,871.

PROPOSALS

AUTOMOBILE FIRE ENGINE

Chicopee, Mass.

The City of Chicopee has authorized the purchase of a motor-driven fire engine, and will receive proposals for furnishing the same until 12 o'clock noon of Saturday, June 24.

Engine must be of not less than 60 horsepower, A. L. A. M. rating, with capacity for carrying at least 1,500 feet of hose, equipped with chemical tank of at least 35-gal. capacity, and with a water-pumping capacity of not less than 600 gal. per minute.

Same shall include full equipment of tools, lamps, horn, chemical hose, 12-ft. and 20-ft. extension ladders, etc.

Full specifications with lowest price should be placed in a sealed envelope marked "Proposal for furnishing motor-driven fire engine for the City of Chicopee," and forwarded to the City Clerk of Chicopee, Mass.

No bids will be accepted nor proposals considered except as above stated.

The City reserves the right to reject any or all bids.

Per order,
SAMUEL E. FLETCHER,
Mayor.

SITUATION WANTED

Position Wanted by Sanitary Chemist, Bacteriologist and Municipal Engineer, Technical Graduate; Ch. E. and E. E. De-grees. Experienced in the construction and operation of water purification plants, design of water distribution systems, chemical and bacteriological laboratory work and the analysis of asphalts, building materials and foods. Best of references. Address "Sanitary Engineer," care of Municipal Journal and Engineer.

BOOK NOTICE

The Art of Roadmaking.—Treating of the Various Problems and Operations in the Construction and Maintenance of Roads, Streets, and Pavements. By Harwood Frost. Cloth, 9x6 in., illus., 17+ 544 pp. New York, The Engineering News Publishing Company, 1910. \$3.00.

This book is intended to give an outline of the history of road building, of the problems which confront the engineer in the location, construction, and maintenance of roads, and of the properties of the various roadmaking materials, in non-technical language suitable for the general reader. No originality as regards the contents or the presentation of new methods or ideas, is claimed, and in the compilation of the subject-matter technical periodicals, Government reports, and a few trade publications, have been drawn on and quoted, the object being to condense into a single volume the fundamental and essential principles of road-making as presented by the most reliable authorities. The book contains an extensive bibliography and a descriptive list of current books and pamphlets on the subject. The Contents are: Poem—"The Road"; Introduction; Part I, Preliminary Considerations; Resistances to Traction; Road and Pavement Economics; Principles Underlying the Selection of Pavements for Different Purposes. Part II, Country and Suburban Roads; Location of Country Roads; Construction and Protective Works; Material Used in Road Construction; Earth, Gravel, Sand and Clay Roads; Broken-Stone Roads; Roads in Mountainous Districts; Control and Prevention of Road Dust; State Aid Laws. Part III, City Streets and Pavements; The Design of City Streets; Stone Block Pavements; Brick Pavements; Wood Block Pavements; Asphalt Pavements; Concrete Pavements; The Cleaning and Sanitation of City Streets; Sidewalks, Curbs, and Gutters; Miscellaneous Roads and Pavements; The Roadside; Appendix; Index.